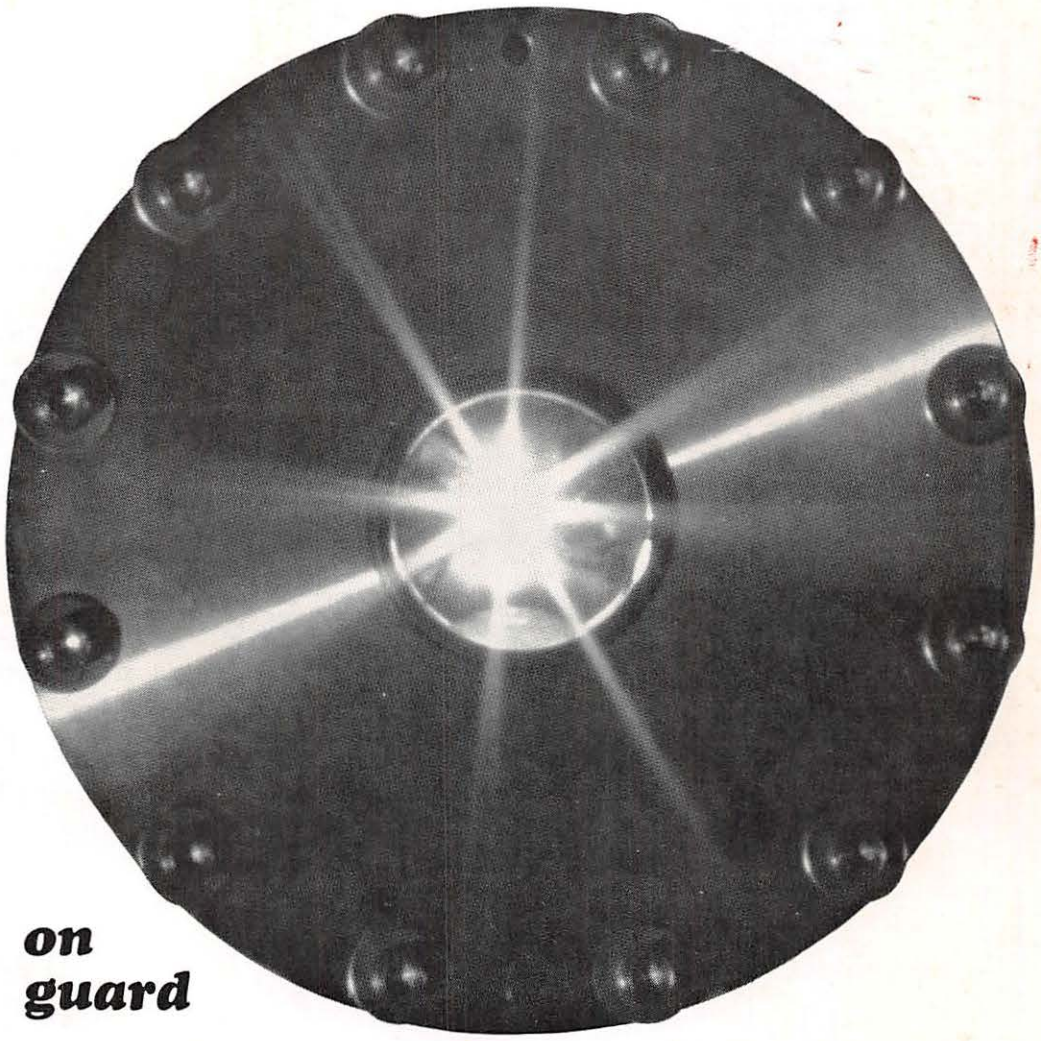
MAY 1968

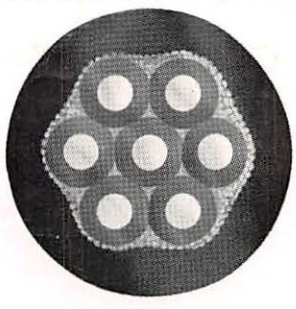
Railway Signaling & Communications



on guard

This is an end view of the source chamber section of a mass spectrometer. The instrument identifies and counts the isotopes in analyzing samples of atomic fuels. White heat reduces the samples to an ionized gas. Measurement of the beam's intensity indicates the quality of the fuel. Specially engineered cladding provides the very utmost in protection.

Below is an end view of a Kerite cable. Specially clad and specially engineered, it provides the protection for the electrical integrity of the cables needed in nuclear power plants . . . against radiation, high temperature, and fire. Nuclear plants can count on Kerite cable today because Kerite research, augmented by many decades of field performance, anticipated their needs. Kerite research and experience are your best assurance of cable performance tomorrow. The Kerite Company • Principal Offices: New York, Chicago, Seymour, Connecticut • Sales Representation Throughout the United States.



Kerite

the cable that lasts...and lasts...and lasts...

Simmons-Boardman **TIME-SAVER** Publication

RACO®

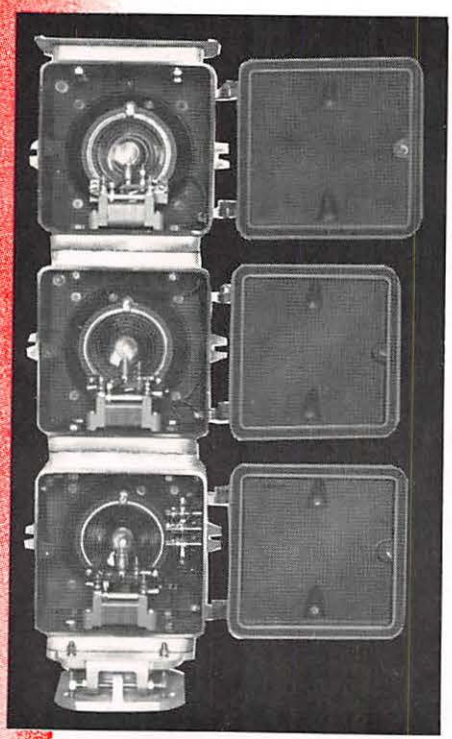
MODEL CLS-10

ALL ALUMINUM

COLOR LIGHT SIGNALS

DESIGNED FOR

MAXIMUM BEAM CANDLEPOWER



MODULAR DESIGN

The RACO CLS - 10 is available in 1, 2, 3 or more unit packing for vertical or horizontal mounting.

RACO CLS-10

signal head is easily ranged, aligned and fixed in both vertical and horizontal planes. The entire head assembly is weather tight featuring individual doors fitted with closed cell neoprene gaskets. Lenses and lamp receptacles are pre-focused and sealed at the factory to assure maximum optical efficiency.

ALL ALUMINUM

except ladder assembly which is galvanized steel, to assure long life with minimum maintenance.

LIGHT WEIGHT

offers easier handling and installation . . . cuts shipping costs too . . . the 3-unit assembly weighs less than 100 lbs.

RACO ENGINEERED to provide dependable signal indication under all operating and weather conditions.

MEETS AAR SPECIFICATIONS

MEMBER RPI RAILWAY PROGRESS INSTITUTE

For complete details contact:

RACO PRODUCTS ® ENGINEERED FOR LONG LIFE

Railroad Accessories Corporation

Main Office and Plant: 4650 MAIN STREET N.E., MINNEAPOLIS, MINN. 55421
Office and Plant: 7615 NATIONAL TURNPIKE, FAIRDALE, KY. 40118

IN CANADA: Vale Enterprises, Ltd., 1120 Claire Crescent, Lachine, Quebec

Circle 1 on reader service card on page 38

The battery and ½

Now you can buy nickel-iron batteries directly from us.

And get all the benefits of sales and service from the experts. From now on nickel-iron signal batteries will be sold by Exide Railroad Specialists. And, since we are the only maker of nickel-iron batteries, we've learned quite a bit about this type of packaged power during the last 50-plus years.

You already know the proven reliability of the nickel-iron battery in signal service. No battery can take the electrical abuse a nickel-iron battery can. Things like accidental shorting, over discharging, even reverse charging. And it's made entirely of steel. No battery lives as long as a nickel-iron battery.

If you still don't know why we call our nickel-iron battery a "battery and ½" call your Exide Railroad Specialist. Or write: Industrial Group, ESB Incorporated, Box 5723, Philadelphia, Pa. 19120.

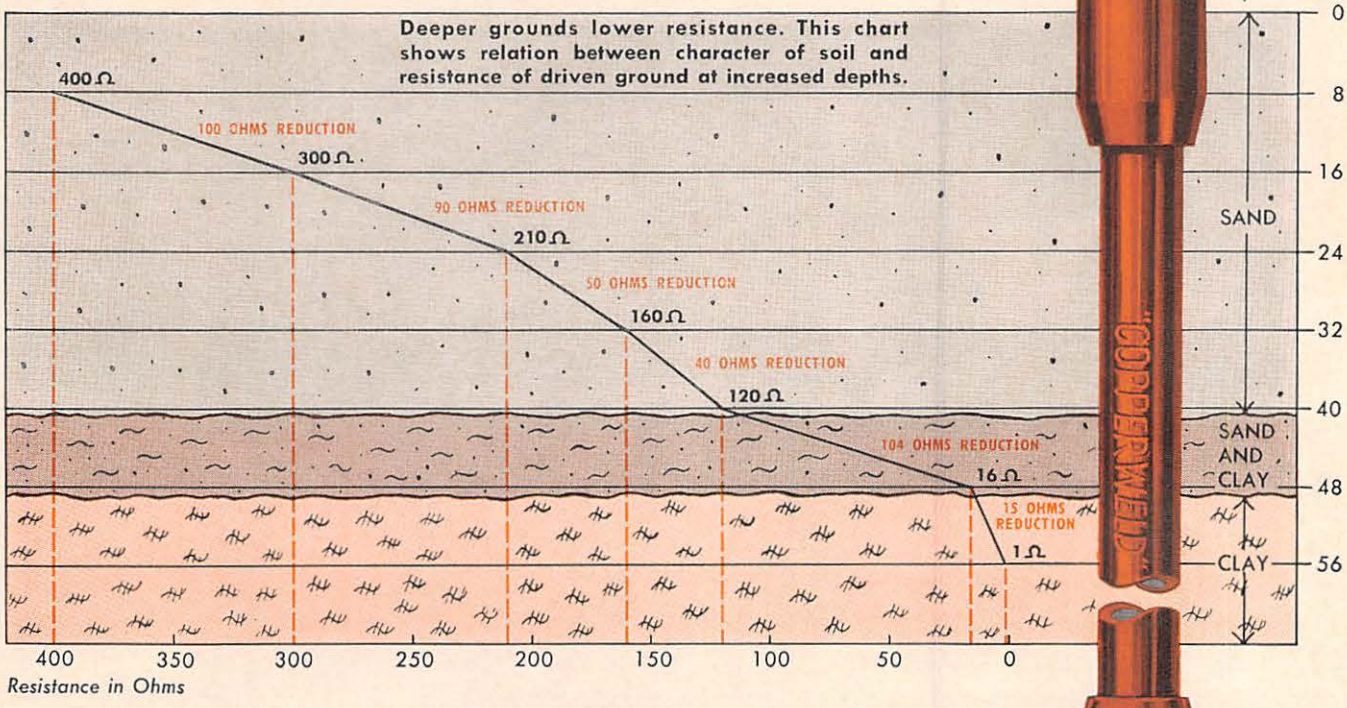
World leader in packaged power.

ESB Exide®

FOR SAFE GROUNDING . . .

DRIVE DEEP!

TO LOW-RESISTANCE SOIL

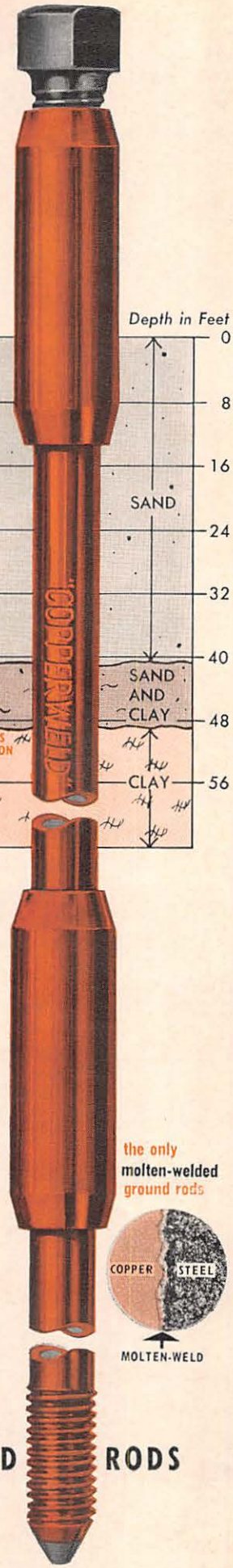


In many areas the surface layer of soil has such high resistance that standard 8- or 10-foot ground rods cannot provide suitable low-resistance ground connections. In such areas, dependable, low-resistance grounds may be obtained by driving sectional ground rods deep into the earth to reach good-conducting soil.

Copperweld Sectional Ground Rods are ideal for deep driving. Their tough core of alloy steel provides strength and rigidity for driving in all types of earth. You can drive as many of these sectional rods as needed to reach low-resistance soil. Each section is joined to the other by a bronze coupling, eliminating the danger of corrosion and poor electrical connections. And once they're installed, Copperweld Sectional Rods are in to stay . . . the heavy copper covering over the entire rod, including the threaded ends, provides permanent protection against rusting.

For tops in safety, improved line performance and reduced service interruptions, drive deep with Copperweld Sectional Ground Rods.

Look for the name "COPPERWELD." For your protection, it is stamped on every Copperweld Ground Rod.



Copperweld® SECTIONAL GROUND RODS

COPPERWELD STEEL COMPANY

WIRE AND CABLE DIVISION *Glassport, Pa.*

For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

Circle 5 on reader service card on page 38

May 1968
Vol. 61 No. 5

Railway Signaling & Communications

Special Report: Automatic Car Identification 13

View From the Crossarm: Hiring and Training C&S Employees 17

Railway Cybernetics: SP Uses Process Control in Retarder Yard 24

News Briefs 28

Product News 38

Editorial Office, 14 E. Jackson Blvd., Chicago, Ill. 60604

Robert W. McKnight — **Editor**
Elsworth L. Abbott — Associate Editor
Grace Rempert — Editorial Assistant

Executive Office: 30 Church St., New York, N.Y. 10007: Robert G. Lewis, Publisher; Fred B. Hecht, Production Manager; John E. Rogers, Director of Circulation; Joel Petrower, Art Editor; George Lubalin, Managing Art Director.
Advertising Sales Department: C. James Fisher, Vice-President—Sales, 14 East Jackson Blvd., Chicago, Ill. 60604; Constance Nicolai, Manager of Contracts, 30 Church Street, New York, N.Y. 10007.
NEW YORK, N.Y., 10007, 30 Church St., Phone: 212-964-3060. W. Arthur Cubbage, Regional Sales Manager; Charles E. Keil, District Manager.
CHICAGO, ILL., 60604, 14 E. Jackson Blvd., Phone: 312-427-3501. C. James Fisher, Vice President-Sales; Kerry F. Sheeran, Regional Vice President; John M. Brennan, Regional Sales Manager, Peter B. Hoagland, Ross Mandic, District Managers.
PITTSBURGH, PA., 15219, 720 Frick Building, 437 Grant St., Phone: 412-471-7871. William M. Champion, Regional Sales Manager, Ronald M. Giallonardo, District Manager.
ATLANTA, GA., 30309, 22 Eighth St., N.E., Phone: 404-872-6720. J. Sidney Crane.
DALLAS, TEX., 75219, 3636 Cedar Springs, Phone: 214-521-2322. Joseph Sanders.
LOS ANGELES, CAL., 90017, 1313 W. Eighth St., Phone: 213-483-8414. Fred Klaner, Jr., The Klaner Co.
SAN FRANCISCO, CAL., 94133, 515 Pacific Ave., Phone: 415-421-7004. Lewis A. Vogler, Lewis A. Vogler & Co.
LONDON S.W. 1, England, 67/68 Jermyn St., St. James's, 839-6318. Max F. Holsinger; Peter Clifton.
MANCHESTER 22, England, Haletop, Wythenshawe Civic Center. Ian Goulden.
PARIS, 8e, FRANCE, 70 Rue de Ponthieu, Stephen Brown-Joussard.
4 DUSSELDORF-RATH, Eitelstrasse 32, Max F. Holsinger; E. Hillerbrand; Herbert Haibt; Reinhard Schomburg.
TOKYO, JAPAN, Sun Gain Shia, Ltd., Shiba Nikkatsu Bldg., 13, Shiba Park, Minato-Ku. C. H. Yiu, Managing Director.

Published monthly by Simmons-Boardman Publishing Corporation, at 800 North Court St., Pontiac, Ill. 61764, with executive office at 30 Church St., New York, N.Y. 10007. Second class postage paid at Pontiac, Illinois.

Member of the Audit Bureau of Circulations (A.B.C.) Name registered in U.S. Patent Office. Printed in U.S.A. by the Johnson Press, Inc., 800 North Court St., Pontiac, Ill. 61764.
Copyright © Simmons-Boardman Publishing Corporation, 1968.

Subscriptions: Address all subscriptions and correspondence concerning them to: Circulation Department, Railway Signaling and Communications, 30 Church St., New York, N.Y., 10007. Change of address should reach us three weeks in advance of the next issue date Send old address with the new, enclosing if possible your address label. The Post Office will not forward copies unless you provide extra postage. Duplicate copies cannot be sent.

Subscription price to railroad employees only in U.S., Possessions, Canada and Mexico, $3.00 one year, $5.00 two years. All others $6.00 one year, $9.00 two years. Payable in advance and postage free. All other countries: $8.00 one year, $16.00 two years. Single copies 75¢.
POSTMASTER SEND FORM 3579 TO EMMETT STREET, BRISTOL, CONN. 06010.

EDITOR'S CORNER

"You, as well as the other departments, should know that your work is not an end in itself but a means to an end. For instance, the C&S department might well consider the other departments of the railroad: engineering, mechanical, transportation, traffic, etc., as their customers, and direct your energies to solving or helping to solve their problems. Make yourselves as indispensable to them as you can. Other departments are not as aware as you are of the benefits you can provide. Interest yourselves and become familiar with all phases of your company. The day is gone, if it ever existed, when any department can isolate itself, and attend only to its own problems as if they were an end in themselves." stated R. C. Grayson, vice-president, operations, St. Louis-San Francisco, at last month's Sectional meeting of the Communication & Signal Section AAR, in St. Louis.

In a similar vein, A. Scheffer Lang, administrator, Federal Railroad Administration, speaking to the American Railway Engineering Association convention in Chicago, commented upon the argument that it was not the place of the individual to discuss AAR policy. He said:

"First, it seems that we as members often forget that on matters of railroad engineering we are the AAR. Second, and I think more importantly, we are professionals whose obligation goes beyond playing some passive role in the affairs of our clients. We are not supposed merely to wait until we are told what to do; we have a responsibility to tell others what can and what needs to be done.

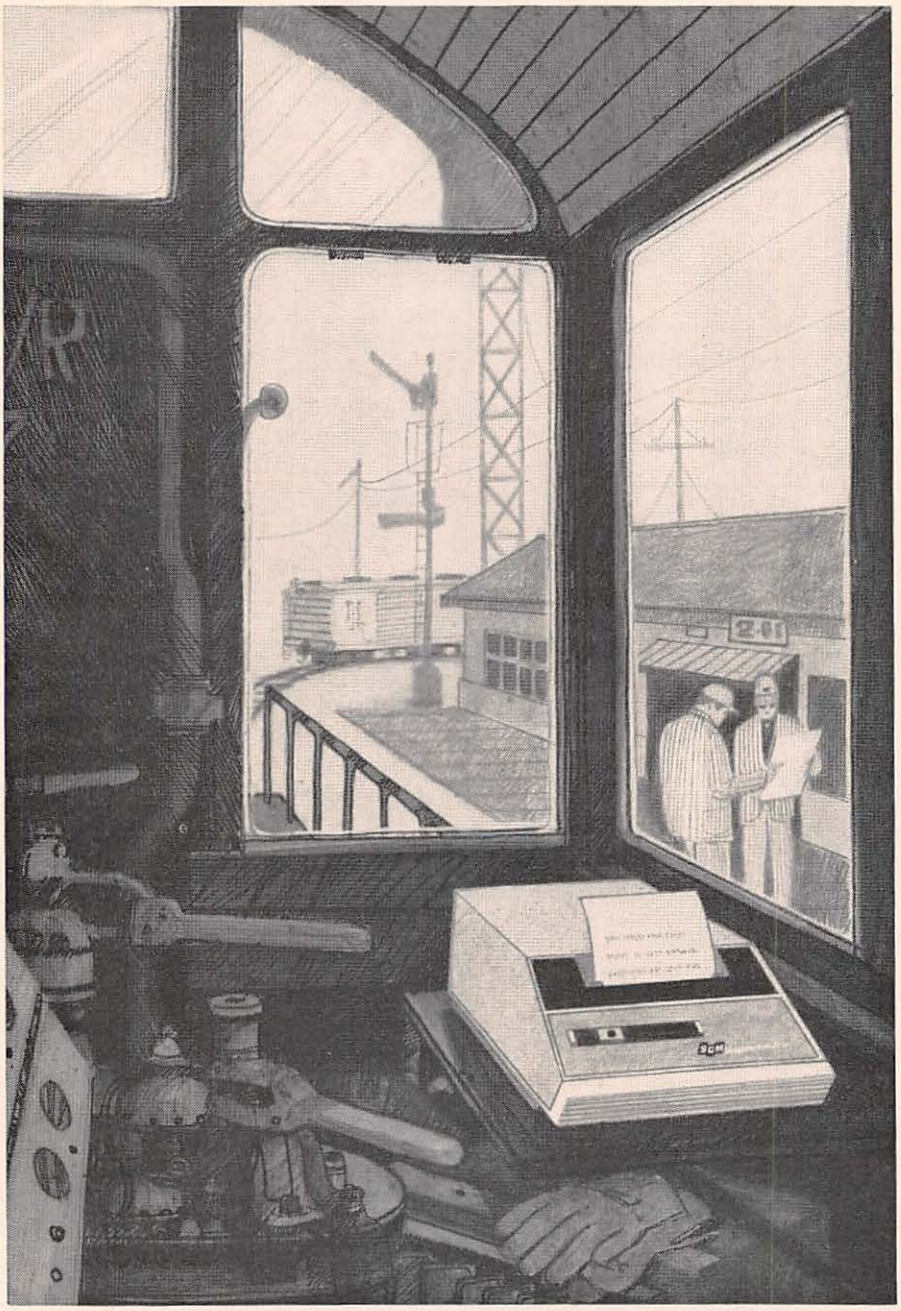
" . . . If we cannot get the right quality of men into our profession then we ought not to wait until someone else creates the environment needed to solve that problem, either."

I know I'll be "roasted" for printing the above comments, but I really believe very strongly that communications and signal men should be more agressive in selling themselves and their accomplishments.

Bob McKnight

Get the message even when you leave your cab– because it's printed!

The new Kleinschmidt Telescripter,™ first radio printer designed for railroads. Compact, plug-in, static-free.



Step away from your engine with a Kleinschmidt Telescripter printer in the cab and you don't have to worry. When you come back, you'll find all your calls waiting. *Printed.*

With a Telescripter printer at work, a busy train crew can concentrate on moving freight and let the machine take the messages.

A Telescripter prints-out complicated instructions in seconds, even when the train is in motion. Time designations. Track numbers. Car numbers. Freight sequence. Everything the crew needs to know is there, error-free, on paper.

In a caboose, a Telescripter printer gives the crew a hard-copy record of all destinations and orders automatically. So there can be no misunderstanding.

A Telescripter train unit plugs easily into any two-way radio. And because the messages are printed, they're always free of static and interference.

Most important, the Telescripter printer is designed with Kleinschmidt quality for extra reliability and sure performance.

For full details on the amazing new Kleinschmidt Telescripter printer, write to Kleinschmidt, Division of SCM Corporation, Deerfield, Ill. 60015. Telephone 312-945-1000.

KLEINSCHMIDT
DIVISION OF SCM CORPORATION

SCM®

Circle 6 on reader service card on page 38

Circle 7 on reader service card

Projections like these are integrally moulded in each corner of the case. The two projections on the end cells of a battery accommodate the handle which slides over them and is clipped in place.

Two adjoining projections form a channel over which the cell Cliplock slides. It is locked in place with metal tabs, top and bottom.

Cell Cliplocks in place with tabs bent in.

MODEL ED-80
80 a.h.

MODEL ED-120
120 a.h.

MODEL ED-160
160 a.h.

MODEL ED-240
240 a.h.

You are looking at only <u>one</u> of the exclusive features of the new Edison Nickel-Cadmium Storage Battery — the Cliplock* method of assembling multi-cell batteries. It completely eliminates wood traying and is so flexible that any standard cell assembly can be readily altered in the field.

This new concept is particularly advantageous in railway signaling and communications services.

So are all the other design and performance features of our new line of Nickel-Cadmium Storage Batteries.

For the complete story, just write us for a copy of Bulletin PB 1121.

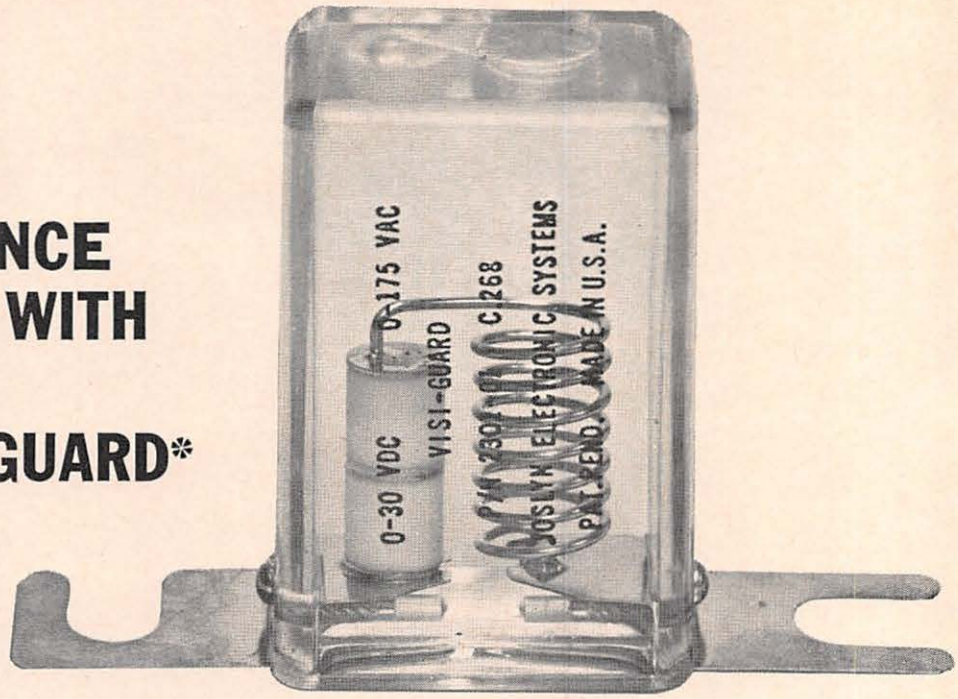
*Patent Pending

THOMAS A. EDISON INDUSTRIES-BLOOMFIELD, NEW JERSEY 07003

IN CANADA: McGraw-Edison of Canada Limited, Primary Battery Division, 75 Brown's Line, Toronto 14, Ontario

McGRAW EDISON

NOW– ONE LESS MAINTENANCE PROBLEM WITH JOSLYN'S NEW VISI-GUARD*



How much time and money, maintenance-wise, do false restrictive failures due to transients in the electronics cost you? Chances are, plenty! Worse yet, the problem they cause for you is compounded when you factor in the cost of disrupted schedules.

Now you can virtually eliminate those damaging transients up to 50 times or more every time they hit your electronics! Joslyn's new lightning and electrical signal type surge arrester — the 2300 series VISI-GUARD — protects your signaling equipment against larger surges and more often than any other means you presently may be using.

Breakdown voltage – 500 v peak. Response time as fast as 0.15μs at 10 kv per μs rate-of-rise. A minimum of 50 rated operations each consisting of a 5,000 ampere discharge current (10 x 20μs waveshape) and resulting power-follow current which automatically extinguishes. Another plus feature: extreme duty discharge capacity of 15,000 amperes 10 x 20μs waveshape.

The Josyln VISI-GUARD is dimensionally designed to directly replace existing arresters using any base including the molded plastic base, or AAR porcelain base, or the three-post porcelain base.

The price for protection has to be considered, of course. But if a device doesn't work, why buy it? With VISI-GUARD you know it will work. For that assurance, $8.60 each in quantities of 100 to 299 is low. VISI-GUARD — the device that frees maintainers for other problems. Another quality product in Joslyn's full line of electronic surge protection equipment for electronic systems. Write today for new JES 140 brochure. Joslyn Electronic Systems, Santa Barbara Research Park, P.O. Box 817, Goleta, Calif. 93017. Tel. (805) 968-3551.

Data subject to change without notice. Prices f.o.b. factory. *Pat. Pend.
Complete specs available in VSMF, Visual Search Microfilm File

JOSLYN
ELECTRONIC SYSTEMS

052

Circle 11 on reader service card on page 38

At one time it would have cost too much to link this small railway station to the line's main microwave system. But not any more—thanks to the 71F by Lenkurt.

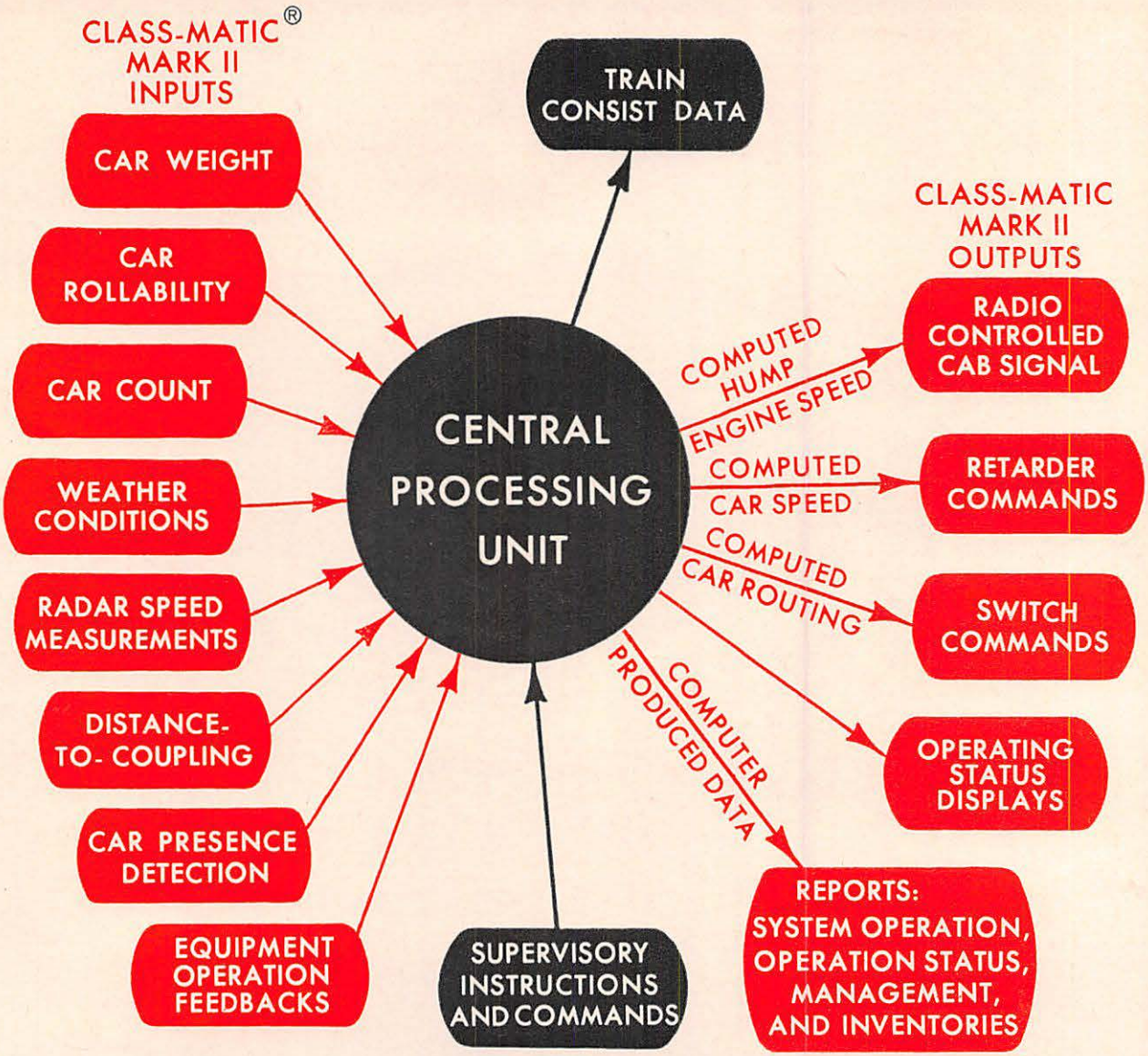
Lenkurt's 71F is a 1 to 300-channel 2 GHz microwave radio system designed specifically to provide economical low density "feeder" routes from communications main lines to remote railway stations and control centers.

Its 2-Watt output improves path reliability at the same time as it decreases antenna size and tower loading. The radio cabinet and all plug-in units are r-f shielded to eliminate VHF interference. And its modular construction means easy maintenance and few spare parts. What could be more important when your 71F is miles from the nearest technician?

For more information about the economical 71F, call or write Lenkurt Electric Co., Inc., San Carlos, California.

LENKURT ELECTRIC
Subsidiary of
GENERAL TELEPHONE & ELECTRONICS

Circle 9 on reader service card on page 38



CLASS-MATIC MARK II

"Shipper-oriented" car classification

A satisfied shipper . . . that's the real heart of this diagram. The central processing unit (a digital computer) and its peripheral inputs and outputs are all a means to one end—shipper satisfaction, cars delivered, or picked up, on time, gentle handling, prompt location reporting.

Class-Matic Mark II is for your big yards, where you have heavy traffic demands . . . and no time for delays. It can dovetail into system-wide computerization . . . and offers you 14 other solid benefits we'd like to discuss with you.

Ask your GRS representative about Class-Matic Mark II.

P.S. For your smaller yards, ask him about "Speed Frate."

GENERAL RAILWAY SIGNAL COMPANY

A UNIT OF GENERAL SIGNAL CORPORATION

ROCHESTER NEW YORK 14602

ATLANTA BOSTON CHICAGO MONTREAL NEW YORK OAKLAND ST LOUIS ST PAUL

3427

Circle 10 on reader service card on page 38

Mister, can you spare $20.00 for a cup of water?

No joke. By the time maintenance crews make their appointed rounds, adding water to your communications batteries, you could be paying that much . . . or more.

The solution? Use C & D lead calcium batteries and make up to 12 times fewer maintenance calls.

How? By adding water only once every three years, for one thing. Compare this with 6 to 12 times each year for conventional antimony designs.

By eliminating equalizing charges, for another. C & D lead calcium batteries never need one if kept on the proper float charge. Antimony type batteries require a check charge at least 6 times a year to determine if an equalizing charge is necessary.

$20.00 is a lot of money for a cup of water; spare a few minutes and get the maintenance saving facts. Write C & D Batteries, Conshohocken, Pa. 19428.

C&D BATTERIES

DIVISION OF **ELTRA** CORPORATION

Washington & Cherry Streets, Conshohocken, Pa. 19428

Circle 12 on reader service card on page 38

Upgrading communications doesn't have to cost $300 per mile. Ask your Stromberg-Carlson Man-on-the-Scene.

You can expand and upgrade your telephone communications without stringing another foot of wire or placing a single pole. A modern carrier system superimposed on your present facilities will do the job at minimal cost.

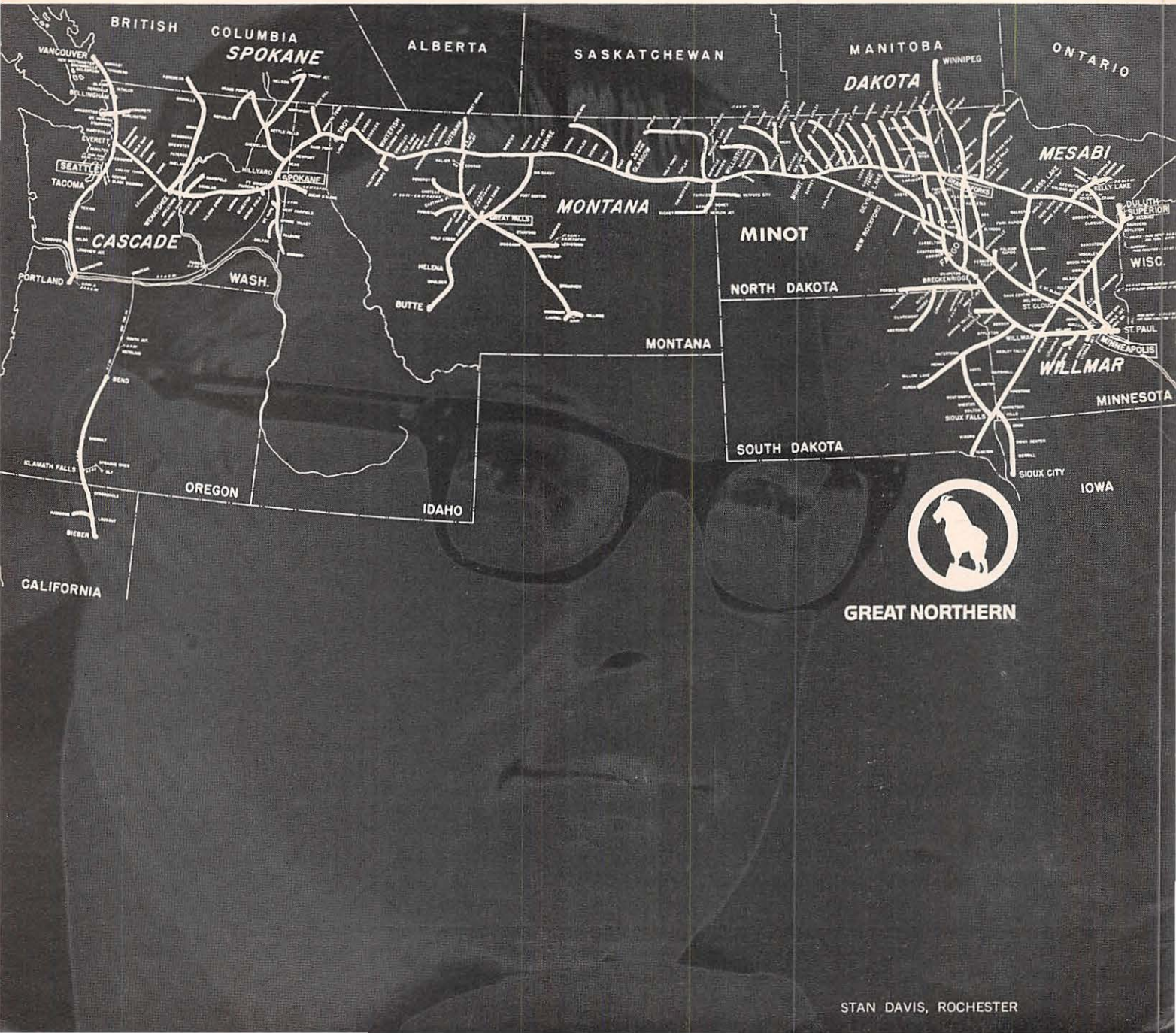
For example:

S-C 761 PARTY-LINE CARRIER. A transistorized medium-haul, open-wire carrier system that reduces load on message circuits up to 75%. Upgrades way stations operating with 35-40 parties per line to only 10 parties or less per line. For added efficiency and economy, the 761 is easily converted to the 765 Trunk Carrier system.

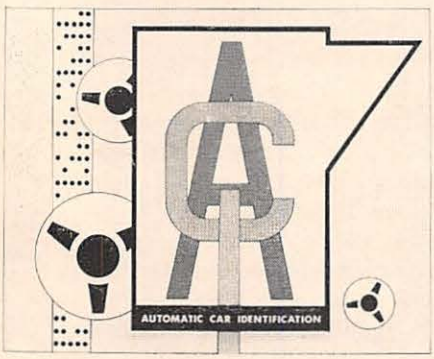
FREQUENCY-RINGING TRUNK ADAPTER. This unique Stromberg-Carlson product works hand in glove with party-line carrier to provide multifrequency ringing. It fills the bill when you're faced with the limitation of an existing PABX that offers only straight-line ringing.

The Stromberg-Carlson Man-on-the-Scene is as near as your telephone. He is backed by our complete customer services that include everything from systems planning to financing. Call him at 716-482-2200. Or write Railroad Division, Stromberg-Carlson, 100 Carlson Road, Rochester, N.Y. 14603.

Stromberg-Carlson
A Subsidiary of General Dynamics



STAN DAVIS, ROCHESTER



SPECIAL REPORT, part 2

Automatic car identification

• Optional Equipment

• System Configurations

• Communications Interface

Optional equipment can be integrated into the KarTrak ACI system to increase its flexibility. Such items include a carrier index, buffer storage, message generator, calendar-clock, piggyback format control, stacked container capability and an additional scanner for a dual system.

• **Carrier Index.** Sylvania's ACI system uses a numerical code only. The carrier index is a read-only memory device which is used to convert the first four digits of each label into the type of car and reporting marks of the car. The AAR has assigned the first digit for the equipment code or type and the next three digits are the billing road code.

The equipment code digits are 0 or 1 for railroad or private car line owner, 2 and 3 for trailers, 4 and 5 for containers, 6 for work equipment, 7 for passenger equipment, 9 for locomotives and 8 for cabooses. A reason for a general equipment type to be assigned this first digit on the label is to make it unnecessary to re-number or re-stencil locomotives or rolling stock of the same owner which have identical numbers.

The carrier index must be used where the output of the ACI system is alphanumeric. If the output of the ACI system is used as an input to a computer, the carrier index is not required. The computer can be programmed to convert the numeric information into car initial and numbers, and do it for all ACI systems on the railroad.

• **Buffers.** A train traveling at 80 mph generates ACI data in excess of 2400 baud. Because most data transmission networks used by the railroads operate at 75 baud or less, it is necessary to have a storage medium to store data at high speeds to accommodate fast moving trains and transmit this data at relatively slow speeds after the train has passed. Two different storage units perform as buffers: magnetic tape and core.

An endless loop magnetic tape buffer features simultaneous read and write capability with a storage capacity for information from ten 200-car trains. It is designed to play back on command, and in the event a train approaches while the buffer is in the playback mode, the new information will be stored and played back on command without generating any contention problems. The unit has the built-in capability to retransmit data on command, one character at a time. When this feature is used in conjunction with some of the interface options, it is possible to retransmit all or part of any message as required.

The core buffer is functionally identical to the magnetic tape buffer. It is designed to store information from up to 500 labels in any grouping of messages. As a special option, information from an additional 500 labels can be stored.

• **Message Generator.** This unit is used to designate the scanner number or location, train direction, message sequence number, computer directing codes, end of address, format number, start of message, end of message, end of transmission, and other fixed information. The message generator has a 64-character alphanumeric capacity, and in addition has a capability to receive variable information from four different sources, i.e., calendar-clock, train direction, message sequence number, plus any special input.

• **Calendar-Clock.** This unit generates three characters (001 to 365) of information to indicate the day of the year, and four characters of information to indicate the time of day in 2400-hour format. This par-

ticular information is fed to the message generator and is part of the message preamble and/or suffix as desired. The calendar-clock option cannot be used without the message generator.

• **Piggyback Format.** The basic system records the label data in exactly the same sequence that it passes the scanner. In the case of trailers, it may be desirable for the output to have the flat car number fisrt, followed by the trailer initials and numbers in the order that they appear on the flat car. The piggyback format performs this function for each flat car with either one or two trailers on the car. This unit uses two storage registers to store the full complement of one or two trailers. Once stored, the information is read out flat car first, followed by any trailers on the car.

• **Stacked Container Capability.** This control option is similar to the piggyback format control, and must be used with it. The stacked container capability makes it possible to read up to six containers on top of a flat car. The containers may be so stacked that the combination of flat car and two container labels fall directly one on top of the other, or any degree of relative staggering. The output will be formatted to have the flatcar first, followed by all the labeled containers. No provision is made for accounting for unlabeled containers.

• **Additional Scanner.** It is possible within the design of the basic KarTrak ACI system to time share one decoder with two scanners. Using this option permits reading of equipment on two different tracks within 2,000 ft of each other, but not more than 1,000 ft from each scanner to the decoder. However, this option does not permit for simultaneous reading of labels on both tracks. Prevention of simultaneous approach of two trains is essential. If, in the event a second train arrives before the first train is completely processed, the system will only read the first arrival and ignore the second train entirely.

It should be kept in mind that when a buffer is used in the system, it is necessary to include the message generator in order to provide the proper message format needed for proper buffer operation. The buffer must be applied with at least one of the output interface options.

The Sylvania Electric Products, Inc., KarTrak automatic car identification system can interface with data transmission equipment either at the output of the decoder or at the output of the optional buffer.

The basic system available consists of the label, scanner and the decoder. The decoder is designed to output each label as it is read in either 5-level Baudot or ASCII. One interface form consists of 60 ma keying contacts to drive any of the conventional teletypewriter machines. The other output interface available meets the requirements of EIA RS-232-B at signaling speeds specified under EIA RS-269. Through this facility, the basic system can interface with any of the commonly used data sets or data modems.

Sylvania expects that the basic system will be applied where trains are operating at very low speeds, such as at weighing stations. Another application is the interface of the basic system through high speed data sets into a real-time data concentrator which would feed into a central processor. As many as 20 ACI units can interface in this way to a data concentrator.

The buffered system is made up of the basic system with these options added: (1) message generator; (2) core or magnetic tape buffer; and (3) a choice of one of the three available control units: Sylvania model

ACI Configurations

Basic System

Scanner, with mounting mast
9 ft vertical scan, 0-80 mph
—50 deg F to +150 deg F operating environment
Decoder
Parity Check Circuitry
Bad Label Designator
Unlabeled Car Detector
Interface- Standard Scale Interface
Keying Contacts for 60 ma loop for teletypewriter
EIA RS-232-B at EIA RS-269 signaling speeds
Output Code Selection- 5 or 8 level
Piggyback Capability without Format Control

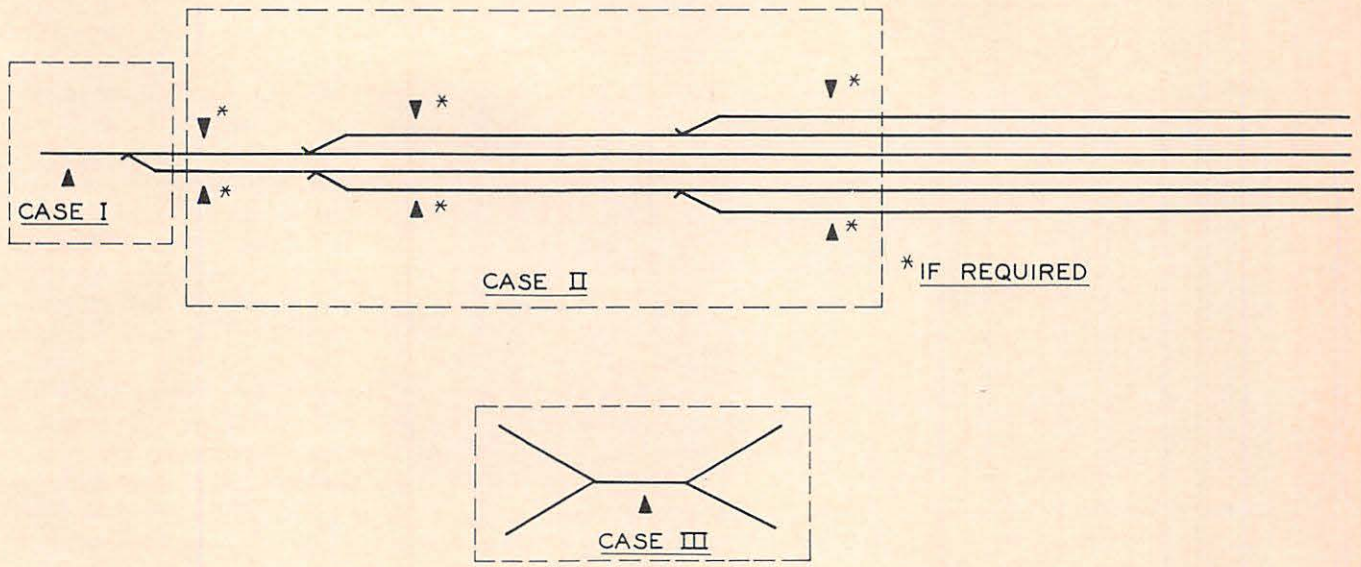
Optional Features

ACI Carrier Index
Piggyback Format Control
Intermediate Storage Selection (Requires message generator)
Magnetic Tape (2400 labels)
Core Storage (500 or 1,000 label capacity)
Message Generator (64-character capacity)
Calendar-Clock (Requires Message generator)
Time of day (xxxx)
Day of year (xxx)
Equipment Housing (Single or double unit)
Additional Scanner for dual system
Stacked Container Capability (Requires piggyback format control feature)

Communications Interfaces

Unbuffered systems (Input on demand, 60 ma EIA)
For direct interface with teletype circuit or data set for voice grade transmission speeds
Buffered systems (No polling or retransmission 60 ma, EIA RS-232-B)
Buffered systems (Computer polled, 60 ma, EIA, answer-back with full retransmission capability as defined by the transmission control unit used.)
5-level Baudot, 83B control unit
8-level ASCII
7-level Sylvania control unit (Provides direct linkage to IBM 1050 communications network)

Multiple-Track Coverage by KarTrak Scanners

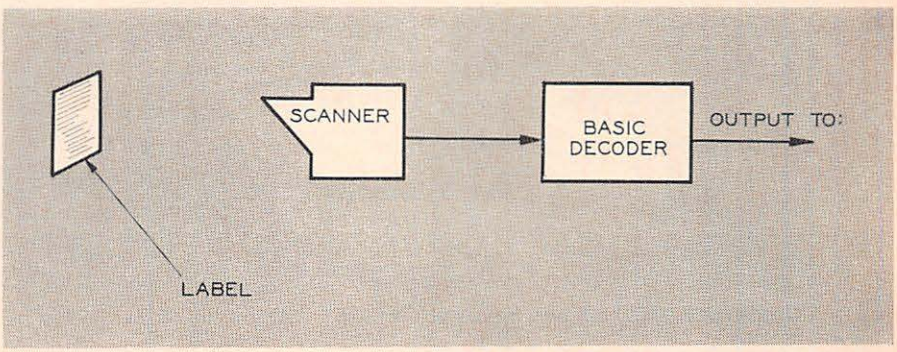


Case I—Single-track territory branches into double-track, but a single scanner can be located to monitor in single-track territory. Switch position indications can be fed into the ACI system to indicate direction and track that trains may take. **Case II**—One solution for scanner positioning is to use the same techniques of Case I to determine direction of trains and routes to be used Another solution is to install additional scanners, shown by asterisks in the drawing. **Case III**—Here again, by positioning scanners in single-track territory and by use of switch position indications (available from CTC or interlocking controls), the direction and routes of trains can be established for the ACI system reports.

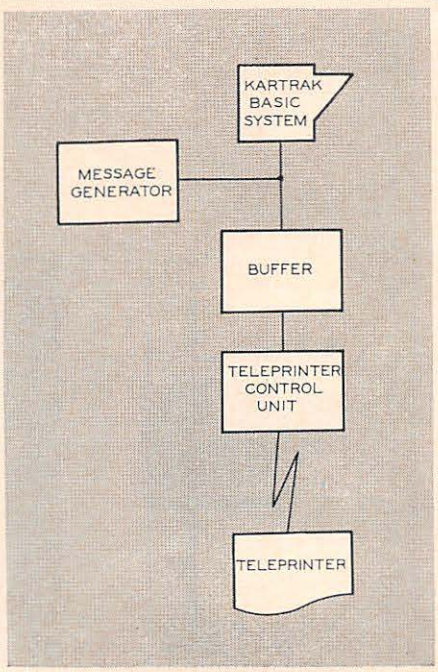
numbers IC-10-I, IC-20-A and IC-30-S. The IC-10-I is designed to be compatible with IBM 1050; IC-20-A is designed to be compatible with AT&T 83B; and the IC-30-S is designed for teleprinter output control.

Through the use of the teleprinter control unit (IC-30-S), a buffered ACI system can operate point-to-point over a dedicated line to transmit data stored in the buffer to centrally located teleprinter units. This teleprinter control is available with either 5-level Baudot or ASCII. Two interfaces are available: one through 60 ma keying contacts which are capable of driving the standard teleprinter telegraph loop, and the other is the EIA interface for use with commonly available data sets. This system may be used in isolated locations, especially where the computer system is not operating on a real-time basis, and the data is manually entered and batch processed.

The buffered system, which uses the 83B type compatible control unit (IC-20-A), is designed to interface directly into data transmission systems. It is designed to interface directly into AT&T's networks and performs all of the necessary functions to respond to polling commands from the master unit. It is assigned



BASIC SYSTEM (above): Output is to a 60 ma teletypewriter loop (EIA RS-232-B with RS-269 signaling), 5-level Baudot or 8-level ASCII.

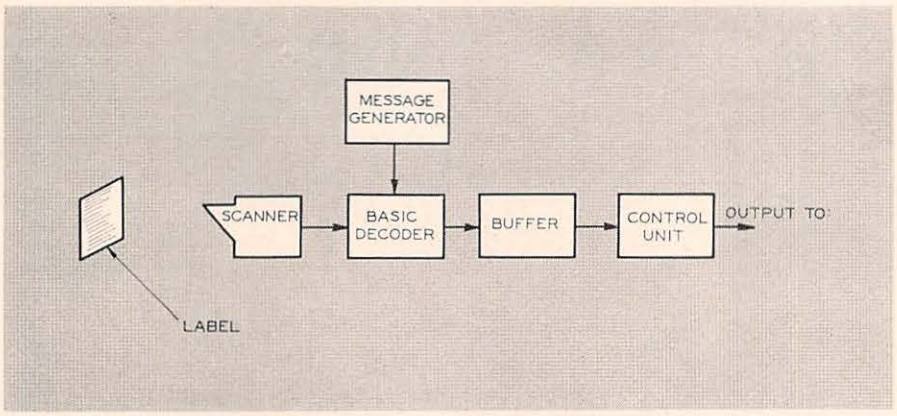


BUFFERED SYSTEM with teleprinter control unit feeds directly into teletypewriter equipment and systems.

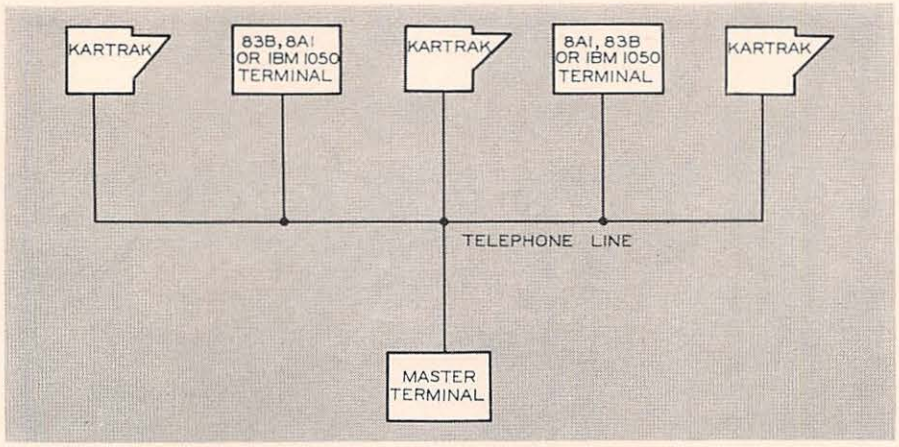
a polling code, and when the polling code is received, the control unit will answer back negatively if there is no message to send. It will respond with the message preceded by the preamble created by the message generator which could contain the call directing codes, message number and other pertinent data. At the end of the message an end of transmission is sent, this being produced by the message generator.

In regular operation of the 83B type system, there are provisions made to detect abnormal operation, such as open line and excessive hits on the line which destroy information. Ordinarily the transmission is halted and an alarm sounds to notify the operator that the message is not being transmitted properly. The operator would then retransmit the message. The control unit available with the KarTrak system has the capability of sensing this alarm and automatically retransmits the message. The number of retransmissions has been set at three by Sylvania.

The IBM 1050 data transmission system is a multi-point system that features a high degree of data accuracy through the use of vertical and longitudinal redundancy checks as well as block and message retransmission capabilities. The Sylvania control unit (IC-10-I) is designed to interface directly into the telephone line network through the use of a data set and by performing the required functions as the 1050 terminals, it offers compatibility in transmission verification and acceptance of ACI data. **RS&C**

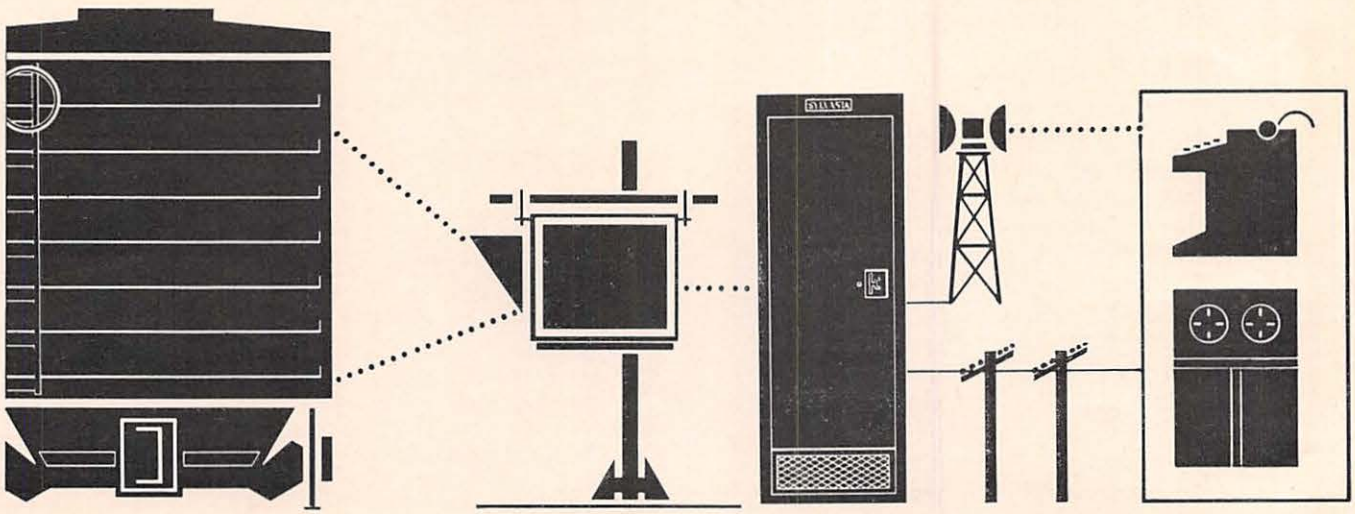


BUFFERED SYSTEMS can have either a magnetic tape or core buffer. Output can be to a 60 ma telegraph loop, EIA RS-232-B with EIA RS-269 signaling, 5-level Baudot, 8-level ASCII or 7-level 1050 IBM. Control units available include 1050 compatible, 83B compatible or teletypewriter output control unit.



COMPATIBLE SYSTEMS can be suited to AT&T 83B or the IBM 1050 system.

Editor's Note: Part 1 of this report was published in the April issue, on page 20, and covered the basic ACI system equipment.



C&S men seek means to fill ranks and train employees

Several questions remained unanswered at the conclusion of the panel discussion on "Problems of Hiring and Training of Communication and Signal Employees" during the Western Sectional meeting of the C&S Section in St. Louis.

One of the questions still floating on the ether waves is one that really deserves an answer. Apparently none of those present felt like taking a stand on the issues involved, instead, the question—phrased by Milwaukee assistant chief engineer, signals and communications D. L. Wylie—was countered by another that was answered by Mr. Wylie with real bite.

What is the general feeling with regards to the idea that we must train signal and communications employees on company time? In other words, pay them their salary and send them to school.

The only response was: "how are you going to keep the employees after you have them educated?"

"I would rather have men of high caliber and quality in my department that we might lose, than to have men who would stay forever because no one else wanted them," Mr. Wylie declared. He added: "this is just the kind of risk we must take. I suggest, however, that this really isn't a risk because if you don't take it you are not going to be in business."

Electronics men appear to be in a better position than signalmen, at least on the Milwaukee. It was pointed out that 30 of their employees have either FCC first or second class licenses. "We have had training for these men for the past ten years. We picked them up and trained them on the property," Mr. Wylie explained. "The problem appears to be in motivating the signalmen in the field to take training. Also, there is little evidence that the right kind of training has been found for them."

Many of our signal employees are underpaid for the type of work they do, Missouri Pacific's signal engineer J. F. Derochie pointed out. "My views are the same as Mr. Wylie's. I would rather have many well trained employees coming along with the hopes that the pay structure and differentials, as compared to other industries, will eventually improve and we will be able to keep these employees. Also, we are competing for this talent with our suppliers."

Another question dealing indirectly with the racial issue was directed to those in the larger cities. *We would like to know what some of the roads in the cities are doing about recruiting colored signalmen and how many there are on the railroads. What problems are encountered? We feel that this is an area where men are available who can be of value to us.*

Frisco general superintendent, communications and

"We cannot substitute the will or ability of others for our own . . . we must prepare plans and strategies for the future."—D. L. Wylie, Milwaukee.

The railroad industry is currently faced with unprecedented problems in maintaining present signal and communications manpower and recruiting new replacements as older forces retire, take new jobs, or leave the services.

With the need for highly trained forces brought about by the rapid advance of science, we are faced with the tightest manpower market in 14 years. External sources are at an all time low, and for many of us, so are our internal resources—the men now on our payrolls. We are the victims, in part, of our success in automating jobs out of existence. In most cases field crews, the basic starting point for men, are much smaller than they were a few years ago.

Many of the men being hired appear to be of a lower quality than those obtained in previous years—reflecting the greater demand—and possible opportunity (at least from their viewpoint) available elsewhere.

The problem is not confined to new employees. We are also faced with the problems of training and upgrading supervisory forces. We are now in what might be termed "the solid state age". Men who are currently skilled in vacuum tube electronics must learn these new solid state skills. Those whose education stopped with mastery of direct currents must face the very real problem of whether their skills will be in demand five years hence.

All of us are faced with technical obsolescence. It is not an industry problem alone, it is a world problem. But, if we can motivate ourselves and our men to "keep up-with-the-times", we can work our way out of what often appears to be an impossible train of events.

We must be aware of the circumstances which have brought our current problems into being: the avenues open to possible solution; and the recognition that solution must come from within the industry. We cannot substitute the will or ability of others for our own. We must play the game as it now is, while we prepare plans and strategies for the future. The future belongs to those who prepare for it.

Candidates for employment with the Milwaukee must have a high school education and be 18 years of age. They must successfully pass physical exams, police record checks, and three aptitude tests. These tests are the Wonderlic, which tests general intelligence; the PTI numeric, which tests ability to work simple mathematical relationships; and the PTI verbal, which checks vocabulary knowledge.

The tests give a general indication of ability to learn on the job. They do not indicate motivation—this must be observed on the job and reported by supervisors. These tests are standard for all hiring. We have used them for

(Please turn to page 18)

(Continued from page 17)
signals, O. H. Summers told the group that they have activated affirmative action on the racial question. They have actively sought to hire colored people for their signal and communications department, "with a resounding lack of success." Mr. Summers added: "last summer we did hire one colored employee on one of the gangs. He stayed for three months and during September resigned to go to college. In some of the larger cities we serve we have had absolutely no success. The applicants that can pass the tests don't want the jobs we offer and those who would accept the jobs can't pass the tests. That is our situation. While we haven't been successful," Mr. Summers said, "we are still working on it."

It was pointed out that on one other railroad in Chicago several colored men are working in the C&S department. One colored employee has been with the road for five years and another for two or three. Three of them have earned their FCC second class licenses and it was reported that they are all doing well.

Mr. Wylie, who moderated the panel discussion, said that within the colored race there is a reservoir of very capable people who can meet the requirements for C&S employees. The problem is to find them. Also, they must be accepted by those already on the payroll, but, "I don't think this is as much of a problem as some may think," he added. "We have three of them in our relay office in Chicago and they are all talented and capable in their jobs. Two of them were trained in the Army."

One man indicated that the railroads have failed to make their needs known to the public and suggested that they should advertise in the larger cities and tell their story. He added: "before I was hired I didn't know that there was such extensive signal and communication facilities on the railroads, nor that such interesting work existed. It was just luck that I found out about it."

Illinois Central assistant to signal engineer, T. J. Kremer commented that it has been their experience that those people contacted in the larger cities don't want to leave the edge of town. "Our railroads do extend beyond these limits and in talking to those applicants from the city, they just don't want to leave town. Consequently, we have not done much recruiting or advertising there because it has not been profitable. We find we can obtain employees that will stay with us longer if we get the fellows from downstate and from smaller towns.

"Employees from the rural areas and the smaller towns appear to be accustomed to harder work and they are more adaptable. We have two things to contend with: we must get the work done and much of it is manual, and secondly, we will train these employees for better jobs later. We must temper our judgement with what is available. It is not a question that we don't advertise, it is only that it does not work," Mr. Kremer concluded.

Mr. Wylie pointed out that the results varies from city to city where they have advertised for employees. "The results have been spotty. We have recruited some good people in this way and we have had some come in that are not qualified, but, we continue to do it. Generally, however, we go to the smaller towns," he said.

C. J. Chamberlain president, Brotherhood of Railroad Signalmen, pointed out some of the problems that have been brought to his attention by union members. Most of these apparently fall into two general categories:

Wylie—(Continued from page 17)
selecting communications forces for 12 years and for 5 years in the selection of signal forces.

Under our union agreement, the new employee has a 60-day probation period. First line supervisors are required to make written reports and recommendations regarding permanent retention prior to the expiration of the 60 day period.

Men considered for promotion to supervisory positions are further tested and screened by our director of personnel. Tests are given which measure motivation, leadership qualities, and initiative.

These tests, like most things which are new, were initially viewed with much skepticism. This is no longer the case—they are now regarded as an important and indispensable tool.

The Milwaukee is currently using a varied arsenal of training approaches. A most useful one is a tuition refund plan. Under this plan employees may take job related courses—receiving a 75% refund on the total cost of tuition and books on successful completion of the course.

Employees of the Chicago general office are currently enrolled in a variety of junior colleges, and colleges in the area. An 8-course curriculum has been adopted as the general minimum standard for those seeking supervisory status. Employees desiring consideration must plan on securing training equivalent to the following: General Engineering Drawing—101, Introduction to Basic Math—110, Intermediate Algebra—111, Electronics: AC-DC—100, Electronics—101, English Composition—101, Introduction to Psychology, and Principles of Management.

Taken at the rate of one course per semester the eight courses can be completed in three years.

Signal draftsmen are usually started on this course a few months after appointment with the expectation that they will complete it in three years.

For field forces, we pioneered in setting up a correspondence course in electronics. We now have a 3-section, 24-month signal electronics course which costs $295. There are 46 lessons in the course. Response of field signalmen has been slow, but 6 field supervisors are enrolled.

There is a similar, slightly more comprehensive course in communications electronics. This course has 69 lessons, costs $390, and takes 37 months to complete. This has been enthusiastically received by the men. We currently have 10 men and one supervisor enrolled. Thirty men have completed this course.

For supervisors and men who have had electronics training and have FCC first or second class licenses we have a special advanced course in solid state electronics. This course has 18 lessons, costs $120, and takes 12 months for completion. Ten men have completed this course. While I am proud of the results of our technical training efforts to date, we still have a long way to go.

One of the problems in inducing signalmen to take the courses is the vast gap between the theoretical work of the course and practical day-to-date problems faced by the signalman on his territory. We are still searching for a solution considering pay structure and job advancement, including some new job levels, as positive motivating factors.

We admit that we do not have all the answers, and we are looking hopefully to the work of AAR C&S Committee G—Education and Training, for guidance in the months ahead.

inadequate wages and sub-standard working conditions away from home.

Efforts of the union to correct these conditions were outlined by Mr. Chamberlain: "You are all aware that the Brotherhood has a very extensive wage movement underway. The basic wage structure is pitiful. It would be difficult to attract new employees through advertisements when you have at the bottom of your ad the average rate of $3.27 per hour. I don't think that anyone can argue with me that wages are the basic attraction. Higher wages, therefore, would attract a better caliber of people. I think wages are the primary motivation.

"Another thing, we are not a mobile society today. People have established roots, they don't want to go away from home. There is little incentive for those employees who accept jobs away from home. Working conditions and living conditions are far from the best. In some places they are far from good. You all know the conditions of your camp cars.

"Recently your employees received, through the process of arbitration, a very meager and wholly inadequate, away from home expense allowance—a dollar a day on the camp cars. Some of the carriers are now trying to get away from that. You cannot expect to get anybody to go out on the gangs and live under those conditions.

"I can assure you that the Brotherhood is aware of the skill and knowledge required of workers in the craft and we will work with you to establish a training program.

"Skill holds a position of importance and obviously must be taken into consideration when making job assignments. Seniority alone is not the only controlling factor, we recognize that.

"We are ready to sit down and work out these problems with you and I feel it would be to the advantage of everyone concerned if we do it soon," Mr. Chamberlain concluded.

It is usually accepted that a signal or communications employee will frequently be called to work out of town. When an employee is also attending school such assignments will interfere and interrupt his education. *"What provisions can be made by the railroads to minimize this interference?"* "You are obviously referring to people who attend classroom sessions. We have a number doing this. The case of each person must be considered in view of his job demands, and what effect it will have on his job if you tie him up certain nights each week for training. I think you must decide how much value this training is going to have. If you decide it is valuable enough to have him in town a couple of nights a week, you agree with him and his supervisors that this will be done. This doesn't have to be done continuously, you may do this for one man for this semester and another man later. The fact that the man is willing to attend school on his own time is a sacrifice on his part which benefits both himself and the company, "Mr. Wylie answered.

"I think most companies will find that in five years, perhaps a little longer, they will be taking advantage of various levels of off-the-job education and training for their employees. This will probably average three to six months every four or five years in which they will send employees to school. It is going to be that important to

(Please turn to page 21)

"I would like to see regular training sessions conducted during working hours by the most experienced gang men."—E. R. Terry, N & W.

In the good old days a green young helper was assigned to a signal gang made up largely of older men with many years' experience. This helper worked with and watched skilled men and learned his trade. This was the training program and it served well at that time.

When our experienced men began leaving us, through retirement or for other reasons, we lost many of our teachers. The average age and skill of the men on the gangs also decreased.

We have always made the AAR Signal Principles and Practices available to our employees, but, there was no program or scheduled use of this material. In 1956, after the AAR established the visual aids, we obtained copies and implemented this type of training.

On the first tour of our western region with this visual aid training program, the response from the men was excellent even though the sessions were held after working hours. Subsequent tours of the region brought much less enthusiastic response and this program died a natural death, partly because the men would not cooperate and devote some of their free time to learning.

On another region of our railroad, our signal shop outfitted a passenger coach with a tie-mounted M-23-A switch machine, a model 10 crossing gate mechanism, a CP valve, a crossarm with pole terminal box fitted up as a junction pole, a switch circuit controller, and three complete signal locations with cut sections between signals (wired for coded track circuits) with miniature signals and rails.

This car was used by the various construction gangs for training, with a staff supervisor in attendance. The AAR visual aids were shown in the car. Men could then work on actual circuits and equipment after viewing the visual aids.

Our experience with the sessions on this region was similar to that on the western region. Attendance was excellent at first, then it declined gradually. Again, the men were unwilling to devote their free time to learning something about their job.

Later, 1½ hour sessions were held—the employee devoted half of his lunch hour and the remaining hour was held on company time. Before we could give this divided time set-up a fair trial we had to return the coach to the car department.

As for hiring, we failed to modernize our practices and we are now paying the penalty. We continued to find our men by spreading the word when there was a vacancy, and by beating the bushes. This worked when jobs were few—it does not work now.

We have difficulty attracting new employees. We cannot hold those we do attract. In 1967 there were 57 applicants for jobs. We hired 41 of them and only 8 are still with us. Why did these employees resign? The principal reason given was that they didn't like "being away from home all week."

I would like to see training sessions conducted regularly during working hours by the most experienced men on each gang. Attendance should be compulsory and progress reports should be made.

We do have a program which provides employees an opportunity to enroll in various correspondence courses to further their careers. Any employee taking advantage of this plan and completing the course with a grade of "C" or better is reimbursed 100% of the cost. This is a good program, but, I feel many of these courses are not basic enough for the helpers. I believe that the very best signalmen are trained from the ground up.

Introducing the HH-300 Du Mont's FM hand-held two-way radio

On board, in the yard, or along the right of way, no portable, two-way radio exceeds Du Mont's HH-300 in reliability and performance, wherever lightweight communications equipment for direct voice contact with stations, mobile units or other portable transceivers is required. The Du Mont HH-300 "Railroad Series" hand-held FM radio weighs only 30 ounces, is completely solid state, doesn't mind water or snow and is reliably rugged. It operates in the VHF range of 132-174 MHz with a power output of more than 2 watts. Simplified circuitry consists of 14 replaceable plug-in modules, allowing fast, easy service by any maintenance organization. Optional accessories include five channel operation, continuous tone squelch, railroad chest harness, rechargeable nickel cadmium battery and an exclusive new Du Mont development in a mercury battery pack utilizing low cost replaceable cells. Sound like something your line needs right now? For more information, use the coupon below. Or call Du Mont at (714) 776-6760.

DU MONT®
MOBILE COMMUNICATIONS DIVISION

A DIVISION OF LING ALTEC, INC.
1515 So. Manchester Ave., Anaheim, California 92803

DU MONT MOBILE COMMUNICATIONS DIVISION
1515 SOUTH MANCHESTER AVENUE, ANAHEIM, CALIF. 92803
Your HH-300 "Railroad Series" two-way radio sounds mighty interesting. Let's communicate.

NAME _____
FIRM _____
ADDRESS _____
CITY _____ STATE _____ ZIP _____

Circle 13 on reader service card on page 38

(Continued from page 19)
the man and to the companies to keep up to date. One of the problems right now is that some of the schools that men would be sent to don't exist, but, they will, Mr. Wylie predicted.

Union Pacific superintendent of communications C. O. Jett said "I don't know what is the matter with this younger generation. The first thing they want to know is, 'are we going to get a deferrment?' The second thing is: 'do I have to travel?' They always make it clear that they are not going to work more than 40 hours a week. The next thing that they say to you is that you work for a decadent industry that is dying on the vine. We have a very bad public image."

The discussion has generally been about technicians, men that work with their hands, however, Mr. Jett pointed out that a year from now, or possibly five years from now the industry will need a much higher caliber of men for supervisors and to fill other supervisory positions. It will not be possible to recruit them from the ranks of the technicians, they must be graduate engineers.

"A review of the technical manuals now furnished by the suppliers would seem to indicate that they were written by PhDs for the benefit of other PhDs. If the technology of signaling and communications continues to advance, as it surely will, we must have highly qualified personnel to interpret these manuals for the technicians. We must recruit graduate engineers. We cannot stand still. We must create a good public image to compete for the technically oriented talent we require," Mr. Jett said.

The point was made that industrial people, the manufacturers, are raiding the railroads' store of technically trained employees. Suppliers were warned that the time has come when they must stop siphoning talent from the industry and consider the fact that if they want to sell to the industry, they should bring some talent into their businesses which they can spin off, back into the industry.

A lot of these big businesses have been built on good will and the orders that were written by young engineers who worked with the railroads. It was pointed out that the supply industry can't take all of that talent away from the railroads and expect those same railroads to turn around and buy advanced equipment when their men cannot handle it.

General opinion was that the problem of training should be resolved from within the industry and train-

(Please turn to page 23)

"Advance training is available. A 100% tuition refund is granted if the employee maintains a 'C' average or better."—T. J. Kremer, IC.

On the Illinois Central an applicant for a job in the signal department must be a high school graduate. Two years of math are desired as well as two years of science, particularly chemistry and physics. The applicant must be between 18 and 35 if he has no previous railroad experience. If he has previous experience, the age limit is 45. An applicant is interviewed and careful attention is given to his social, military, and home backgrounds. He is also given a general aptitude test, mechanical and non-language tests. Physical examinations of a general nature are required, as well as a color perception. In addition he is given an extensive back X-ray examination. Acceptance of the applicant is contingent upon these physical examinations.

After a probationary period of 60 days, a report is submitted by the new employee's gang foreman outlining his ability to work with others, his ability to take orders, and his attitude towards the job. If the report is positive, the employee is eligible for advancement into the training program. He is advanced when a vacancy occurs, after a reasonable time and has had an opportunity to learn the basics of railroading. As the new employee learns, he is rotated to other locations where he is afforded the opportunity to learn more about signaling. If the opportunity [for promotion] is presented at the end of eight 130-day training periods, the employee must accept the first job available to him consistent with his seniority. If this opportunity occurs within a period of less than eight 130-day hour training periods, he may be promoted as his seniority permits.

All applicants advancing must pass written qualifying examinations within 21 work days after they have been promoted from these training periods.

If an applicant fails to qualify and he has completed his eight 130-day training periods, he automatically resigns. If he has not completed these training periods, he returns to training.

Advanced training opportunities are also available. We too have the tuition refund plan for certain related courses which are available to both communications and signal employees. In our particular plan a 100% refund is granted if the employee maintains a "C" average or better. We also have special courses prepared by Cleveland Institute of Electronics for the Illinois Central.

Signal employees showing capabilities in the field are often offered appointments to the signal engineer's office where they can learn circuit design or estimating as well as field inspection. Opportunity for promotion to signal supervisor or field engineer of signals is possible from this level.

The hiring and retention of qualified field employees is becoming very difficult. We just do not have people applying for this type of a job anymore. There is a great lack of availability of qualified new employees.

Difficulty is also experienced in advancing or promoting an employee because of the hardships resulting from transfer. Differential pay is too small and the requirements of the position are too rigorous.

Retaining skilled employees is often a problem because these workers often receive very appealing offers from other concerns who are offering better working conditions and less demanding duties. Offers from other departments on the railroad sometimes hamper us too.

The answers to some of our manpower problems might well be:

- Better and more complete training programs.
- Better pay based on meeting certain qualifying levels.
- Salary based on the merit rating concept, instead of a seniority basis.
- Better personal benefits including housing, tools, transportation, prestige of position.
- Security.
- Promotion on ability and production.

In other words, we need a system based upon employees who are better trained and qualified to produce more and are better paid.

from Marquardt Industrial Products...

RAILROAD COMMUNICATIONS CONTROL SYSTEMS

MIPCO's Chicago Division introduces a new station selection tone control system for train-to-wayside radio equipment as part of its expanding lines of railroad communications control products. MIPCO products range from specialized modular equipment to completely integrated communications systems—meeting the highly diverse and complex control requirements for modern railroad and transit facilities.

MIPCO COMMUNICATIONS PRODUCT LINES

- **Train-to-wayside control equipment, including solid state plug-in amplifiers, power supplies, regulators, timers, filters, relays, etc.**
- **Complete systems for terminal and freight yard traffic control.**
- **Modular sound distribution systems for multiple line control and monitoring.**
- **Special systems for high noise level and hazardous area operations.**
- **Industrial voice paging equipment, intercoms, recording systems, control consoles, cord and cordless switchboards, line filters, loud-speakers, and related electronic equipment and accessories.**

Your MIPCO representative can serve you in planning your specialized communications systems requirements. Call him today.

MARQUARDT INDUSTRIAL PRODUCTS

SYSTEMS AND COMPONENTS
TO SERVE
THE RAILROAD INDUSTRY

MIPCO offers an expanding product line and diversified services to meet the continuing demand for modernization by the railroad industry. Call upon MIPCO for new systems and components for improved, efficient service at lower operational and maintenance costs.

Signals & Controls Division
2771 North Garey Avenue
Pomona, California

- *Grade Crossing Predictor Systems (GCP)*
- *Electronic Track Circuits (ETC)*
- *Pulse Modulated Track Circuits*
- *Constant Voltage Rectifiers*

Chicago Division—Communications
(formerly R. W. Neill Company)
4320 West Montrose Avenue
Chicago, Illinois
Communications

- *Communications Systems for Railway Classification Yard Applications*
- *Communications Consoles, Voice Paging Systems, Loud-speakers, Related Components*
- *Radio Control Equipment, Solid State Amplifiers, Remote Line Test Units, Power Supply Systems*

Howard & Gould Rectifier Products

- *Signal Rectifier and Transformer Systems*
- *Tie-boring and Bonding Drills*

REGIONAL OFFICES:
Chicago:
Signals & Controls—100 S. Wacker Dr.
Communications—4320 W. Montrose Ave.
Philadelphia:
1617 John F. Kennedy Boulevard
Jacksonville, Florida:
1914 Beachway Road
Canadian Representatives:
Signals & Controls:
Vale Enterprises, Ltd.
1120 Claire Crescent
Lachine (Montreal), Quebec, Canada
Communications:
National Sound Services, Ltd.
1785 Bois Franc Road
Montreal 9, Quebec, Canada

RPI
RAILWAY PROGRESS INSTITUTE

MARQUARDT INDUSTRIAL PRODUCTS CO.

Circle 14 on reader service card on page 38

(Continued from page 21)
ing for signal and communications employees should be generated on that level.

The efforts of the C&S Committee G—Education and Training, were commended and it was felt that the committee's current project will soon yield a course designed to provide the means of educating the new signal employee.

Mr. Kremer, a member of Committee G, explained that the training course being developed must be supplemented with on-the-job training. "It seems that the most acceptable means today is to provide the employee with an instrument that can be taken home and studied at his convenience. Our plan is to produce auto-programmed [self-teaching] type of material. We recognize that in the past, the Principles and Practices of the C&S Section were difficult to understand. We are revising this material to where we believe the assistant signalman can understand it. We are not too interested in what the signal engineer thinks of it as an instrument of reference, but what the employee in training can learn from it. He is the fellow we must interest and educate.

"We also realize that there are many signalmen on various railroads who hold that rank, and enjoy that seniority and wage rate, but who are actually not fully qualified. We recognize this and we feel that the employee does too. With the material we are preparing he can learn in privacy. We are not interested in embarassing anyone by pointing out that 'you don't know', we want to provide a method which will permit him to increase his knowledge and make him a more valuable man.

"Efforts will be made to get the railroads to buy these manuals and provide them to signalmen and assistants with one purpose in mind, and that is to provide a method of learning about signals," Mr. Kremer said.

"The more members we have on the committee, the quicker we are going to get this course finished", Mr. Kremer added. He urged that if any of those present were interested, or had knowledgeable employees that were interested, in preparing material for the committee they should contribute.

"I personally have a great deal of optimism, while at the same time I also have respect for the severe problems," Mr. Wylie said in conclusion. "Management is in a desperate struggle financially with factors which affect the industry and at the same time we are trying to revitalize ourselves internally. Fortunately, the people that are in signaling and communications are not faint-hearted or they would have been long gone. Obviously, we all are looking to the future." **RS&C**

"If a training program achieves full effectiveness it must be a program which will meet the needs of the trainee."—J. F. Derochie, MP.

The problem of hiring and training communication and signal department employees is two-fold: (1) Hiring the proper type of worker. (2) Training the proper type of worker.

All applicants considered for employment in the Missouri Pacific signal and communications department must be at least 18, and be a high school graduate or equivalent. There is no set maximum age, but our present practice is to accept applicants up to the age of 35.

Most of the applicants are interviewed in our general office. It is made clear to the prospective worker that he will be required to travel. We also evaluate him and try to determine if he is interested in a permanent position. We question him in regard to his family—if his wife will be receptive to his being away from home during the work week. If the employee is single, we also attempt to determine whether his ties will permit him to be away from Monday through Friday. Wives and girl friends have a strong influence on an applicant's decision to accept our job offer and continue with us.

The aptitude tests we use are those used by most large firms. If the interviewer feels that the applicant should be employed, color perception and hearing tests are given to the applicant. After these tests are completed, the applicant is given the Wonderlic Test consisting of 50 questions. The time required to complete this test is 12 minutes and the applicant must score a minimum of 20. In some cases, a companion test known as the SRA Non-verbal test is given the applicant. This test consists of 80 questions and the applicant has 10 minutes to complete the test and must score a minimum of 40.

After the above tests have been completed, the applicant is given a general physical examination, and if he passes the physical, he is accepted and placed on a probationary assignment.

The probationary period consists of 60 days during which time the worker is closely observed by the foreman, who is responsible for acceptance or rejection of the employee.

Our policy is that a new employee receive fair and considerate treatment by every level of management. This includes consideration for promotion based on merit as well as seniority. We must therefore, have an educational program. The worker can advance by study and passing the required examinations. These workers have earned their promotions and are usually found to be happy on their jobs.

When a new employee has completed his 60-day probationary period, he is given a set of training program texts. There are eight of these texts covering the following subjects: safety, motorcar and other rules; the theory of electricity; terminology and definition; direct current and batteries; standard installations; signaling in general; centralized traffic control; and instruments for testing and maintenance and inspections.

Signalmen, foremen, supervisors and others who wish to continue their education in the signal or electronic field may take courses by correspondence or in residence on our tuition aid plan.

Our retarder yard technicians are required to have an FCC second-class radio operator's license and training for these jobs also comes under the tuition plan.

Our present training program has been helpful in many ways and we hope to improve it considerably in the immediate future. These steps will be taken to meet the demands caused by attrition and as a result of our taking over the Western Union lines.

We now have a special course designed by taking the course offered by the Cleveland Institute of Electronics and picking out the ones we felt were primarily related to the signal field and putting them together to form our own course. At last count, 57 people were taking this course.

Railway Cybernetics

Controls and the Computer: 7

SP has process control in retarder

By R. G. McWhirter
Assistant Superintendent
Southern Pacific
and W. C. Beaton
Systems Engineer
IBM Corporation

Southern Pacific is using an IBM 1800 data acquisition and control system with an IBM 2260 visual display unit interfaced with car counters, wheel counters and presence detectors, to control automatic switching and maintain perpetual car inventory at Englewood yard, in Houston, Texas.

This 64-track retarder classification yard handles about 4,000 cars daily. They are switched into over 100 blocks for forwarding to some 700 industries, three interchange points for seven railroads, and an average of 27 outbound trains per day with cars blocked for various areas on SP lines and for connections at major gateways.

Englewood yard has a single throat, pull back, hump operation with electric switch machines (automatic switching) and radar equipped automatic retarders consisting of one master of six sections and eight groups of two sections each. Maximum cars humped in one day was 4,399; in eight hours 1,612 cars were humped.

A major problem of classification yards has been the temporary loss of cars when they go into a wrong classification track in the bowl. This condition adversely affects the utilization of yard engine time, departure of trains, transfer and industry cuts, and causes car delay. Also, it causes a breakdown in the relationship with customers and parties inquiring about car movements. To provide a solution, the computer is able to maintain optimum accuracy and efficiency as to the location and identification of each car switched.

The computer is used to perform the following: (1) Receive necessary switching information on each car arriving at Englewood and assign a bowl track number. (2) Transmit crest list information to teletype system upon receipt and into a 2260 visual display just prior to being humped. (3) Start hump operation. (4) Monitor number of cars per cut going over the hump crest. (5) Operate the switches required to route the cut to the designated bowl track. (6) Monitor number of wheels in each cut and compare with subsequent wheel counts as the cut is rolling to its destination. (7) Monitor switches to confirm actual car movements, keeping current bowl track inventory. (8) Immediately report discrepancies when car enters wrong track. (9) Perpetually display on the 2260 unit the number of cars in each bowl track and identify tracks occupied by trimmer engines. (10) Report on request the number of cars by zone destination on hand in selected bowl, or receiving tracks available for each outbound train or cut. (11) Prepare and transmit pull list of cars in standing order in all bowl tracks on request. (12) Trace cars on inquiry, furnishing complete information and location. (13) Store all identity and routing information on cars billed in Houston area and assign zone destination to the cars on arrival in inbound cuts. (14) Store diversion and advance information on cars enroute Houston and monitor all cars on arrival, correcting destinations and identifying discrepancies. (15) Prepare delayed car report based on time of delay and schedule of traffic. (16) Make various special reports of cars handled, including cleaning track operation, repair track operation and availability of any type of empty equipment.

The yard office, crest tower and bowl tower are staffed with personnel using equipment connected with the IBM 1800 computer system. The yard office is responsible for zoning of all cars arriving in inbound trains, transfers and industry cuts, and for preparation of the crest list using punched cards.

Equipment at the yard office includes a model 15 Teletype to print out a jumbo-type crest list; a model 28 Teletype to print out the pull list of bowl tracks; an IBM 1050 unit to print out industry cuts, transfers, open orders, diversion discrepancies, etc.; an IBM 1816 printer keyboard used as an inquiry unit on car location and status; and an IBM 1800 CPU card punch and card reader.

The crest tower is a major control point equipped with an IBM 2260 visual display screen and keyboard. Another 2260 display station carries a duplicate image and is at the crest yardmaster's desk. Functions requested by the operator are keyed in using the alphanumeric keyboard. A continuous image of a maximum of 960 characters (12 lines of 80 characters each) are displayed showing crest list (train) number, cresting car information, number of cars on each bowl track, track "collar" (isolation) status, and an area reserved to show

Editor's Note: Abstract of papers presented at 1967 annual meeting of Data Systems Division, AAR.

yard

the crest operator the result of his keyboard operation before transmitting the message to the computer.

Use of the 2260 unit is for the following operations: (1) Start the hump; (2) Change track destination; (3) Prevent cars moving into a track occupied by an engine; (4) Alternate track selection; (5) Insert or delete a car not shown on the original list; (6) Stop and start the operation to permit shoving cars in the bowl; (7) Re-designate track assignments by zone; (8) Display a bowl track for re-humping; (9) Permit cars to be set from one track to another; (10) Display tracks that have been blocked off for engines; and (11) Display bowl tracks and total number of cars in each track.

A model 15 Teletype is located in the crest tower to receive the crest list of trains arriving at Englewood.

The bowl tower is located at the trim end of the yard and is responsible for trimming cars from the bowl, making up outbound trains and outbound yard cuts. At this location there is an IBM 1092 programmed keyboard for communications with the computer. Also, the bowl tower has a model 28 Teletype to receive pull lists, reports and discrepancies, and a model 15 Teletype to receive the crest list.

A normal sequence of the humping operation is as follows: Initially it is necessary to create and transmit a numbered crest list of the cars to be classified in car standing order of the trains awaiting classification. This activity, where applicable, requires the merging of advance orders, diversions, superintendents' orders and expedite orders, switch lists, agents' orders and train consist

SP has process control computer

At its Englewood yard, Southern Pacific is using an IBM 1800 (time sharing executive system) process controller. This equipment differs in many respects from a conventional digital business computer. A feature of this 1800 system is its real-time, time-sharing control and monitor executive programming. Such process control systems are designed to interface with digital as well as analog signals from and to a wide variety of instruments and control equipments. A significant feature of the process control computer is the ability to react to signals generated externally to the computer. Events, such as contact closures and voltage rises, can be interfaced with the "front-end" of the processor in such a way that the computer will temporarily halt execution of a program and execute another "higher program". Upon completion of the servicing of the external event (which had caused the interruption), the computer may under control of the program executive system, resume execution of the interrupted program. Since certain external events may require more immediate service than others, the processor-controller is provided with a hierarchy of hardware and program priority levels enabling execution of programs according to urgency.

In addition, the process control processor selected for Englewood yard is a programmable computer which may be equipped with a wide range of standard input and output devices such as disk (bulk) storage units, card read and punch units, line printers, keyboard printers, magnetic tape units, paper tape read and punch devices and plotters for graphical display. Special equipment employed as an integral part of the processor at Englewood is a matrix keyboard input unit, CRT display stations (with keyboards), and teleprocessing communications adapters.

Such a process control computer, as used by SP at Englewood, is of building-block design for modular expansion as required in both "front-end" (digital/analog input/output) and input/output devices (printers, bulk storage, card and paper tape read and punch, magnetic tapes, plotters, etc.). In addition, a comprehensive process control executive programming system is supplied.

reports. Information derived from these reports and orders will be stored in the computer as they arrive at Englewood yard.

The crest list will list one car per print line, in car standing order. Each line will show the order number of the car, car initial and number, contents, loaded or empty status, car class, coded (zone) destination, assigned bowl track and special instructions. The creation of this list is really the beginning of the bowl switch yard monitor and control system. A hard copy of this list is transmitted to various operating personnel and the list is retained by the computer in disk or bulk storage.

When ready, the crest operator (engine foreman) identifies the train to be humped to the computer via the keyboard of a cathode ray tube (CRT) display console (IBM 2260 display station). The computer will use the stored crest list to begin the sequential selection of switch positions when a car is detected by the cut and car counter at the top of the crest. During the humping operation the CRT display console will display 12 lines (or cars) beginning with the next car to enter the first switch. Subsequently, the progress of the car or group of cars (cut) through the bowl track switching complex is monitored and controlled with the final track destination sensed and stored in a master car record file on disk storage. From the above operations and the originating documents comes the information from which all subsequent reports, inquiries and summaries are generated.

The IBM 1800 computer directly controls four communications lines. A 45.5 bits per second teletype line transmits the crest list to six model 15 teletypewriters in broadcast mode. A second printer line, operating at 75.2 bits per second, transmits requested information to nine model 28 Teletypes. An example of this latter operation is a request transmitted by the bowl yardmaster using an IBM 1092 program keyboard over a 1050 communication (third) line at 134.5 bps directly to the 1800 computer. The request, which may be a pull list, will be answered over the 75.2 bps line. The fourth communication line will send and receive from three industry service centers equipped with IBM 1050 terminals.

All line control, message handling, buffering and processing operations are handled assynchronously with real-time process control of the classification yard as well as input/output device control (card read punch, printer keyboard and disk drives) and display station operation.

An important feature of the entire control system is that of obtaining car position information, as cars are being classified. Each wheel counter relay and presence detector relay is connected to a single process interrupt terminal pair. The switch operate relays, switch position relays and group retarder operate relays are connected to digital output and digital input terminal pairs through three matrix groups.

The switch operate matrix consists of an 8-terminal by 16-terminal electronic contact operate (ECO) array, each intersection being "shorted" by a switch operate relay. Similarly, the switch position detector matrix comprises an 8-terminal ECO by a 16-terminal digital input, contact array, and each "intersection" is connected across a switch position detector relay. The group retarder codes are similarly set by a 4-by-8 ECO terminal pair array.

Each switch or pair of switches in a lap switch area is interfaced to the "front-end" of the computer through two switch position relays, two switch operate relays, one presence detector (interrupt) relay, and one wheel counter relay. At the crest tower, the "front-end" of the computer is wired to four relays for the purpose of logically counting wheels, counting the number of cars per cut and sensing the beginning and end of a cut (one or more cars coupled together) before entering the master retarder and first switch. The car counter consists of two wheel counters spaced 6 ft apart and a programmed algorithm to logically count cars based on the sequence of process interrupts from the wheel counters.

Normal operation of the automatic switching system for routing cars is handled by the IBM 1800 computer. However, the existing automatic switching equipment made by General Railway Signal Co. is maintained for back-up purposes. One Nixie tube display at the retarder tower is operated through an ECO group. Its function is to show track destination numbers to the retarder tower operator for cars about to enter the first switch. A maximum of four cars can be shown on the display. The effect of loading the track destination numbers in the Nixie tube display at the retarder tower is to establish a bowl switch selection code for the existing GRS control code storage (CCS) system. As a result, the GRS control system is activated and sequenced as cars are switched through the bowl switch area. Operation of the bowl switches by the GRS CCS system is locked out with a key relay set by the IBM 1800 computer while it remains in control of the bowl switch system. This method of establishing the track destination code in the backup GRS system provides a technique for continued control of the cars in the bowl switch area if for any reason control is lost by the computer due to a lengthy power loss or because of a request by the crest tower operator to the computer (via the 2260 keyboard) to relinquish control. In addition the crest tower operator may choose to lock out computer control (but not its function of sensing the bowl activity) by manually opening the key relay.

Completely parallel operation of the IBM 1800 computer control system and the GRS CCS backup system in which totally duplicate control is maintained is not technically feasible due to the fundamentally different control methods. The actual degree of parallelism implemented does, however, provide a continuously operating backup system which is readily switched to on-line control by the operator or automatically switched in the event of a system power failure longer than momentary.

There are two important functions being planned for the future. The first of these will be to interface the computer with the electronic scale to handle weight information. A second function will be to reserve space on outbound scheduled trains for each car loaded and released by shippers in the Houston area and for each car arriving on inbound trains and from connecting lines.

Modularity of construction in the 1800 processor controller will allow field expansion of this system from 16384 words (18 bits) of core storage and over 1 million words of disc storage to 32,768 words of core storage and allow an additional 512,000 words of disc storage facility. **RS&C**

The Unsnarler.

The Unsnarler! That's the Servomatic® Switching Area Crossing Control System. It's designed specifically for busy, low-speed industrial switching areas. Servomatic keeps highway traffic flowing—even at crossings in the busiest switching areas.

Operation is simple and effective. Crossing protection controls operate when a train approaches a crossing. In addition, when a train stops or moves away from the crossing, Servomatic terminates the warning devices and permits pedestrian and vehicular traffic flow. As the train re-approaches, crossing controls are re-activated—providing statutory warning time automatically. And there's no need for manual supervision.

If you're concerned about increased highway traffic and yard activities affecting the movement of your trains . . . investigate the Servomatic. Call us and get all the details on the unsnarler.

servo corporation of america

servo

railroad products division
111 new south road
hicksville, l. i., new york 11802
phone: (516) 938-9700

Circle 2 on reader service card on page 38

NEWS BRIEFS

• AMERICAN TELEPHONE & TELEGRAPH CO. has filed a tariff with the FCC for an extensive in-service trial of a new high-speed switched message data service. This new service permits the transmission of sequential signals for data and facsimile at rates up to 50,000 bits per second and includes a channel for voice coordination. According to *Telecommunications Reports*, the 50 kilobit switched service will permit such communications between suitably equipped stations located in or connected to the Chicago, Los Angeles, New York and Washington 50 kilobit switched service exchanges. The service contemplates station-to-station calling on a sent-paid basis only.

• CANADIAN PACIFIC plans to construct a $12 million computer-controlled hump yard at Calgary, Alta. Construction will begin this year, and the yard is scheduled to go into operation in 1971. The new facility will have electro-pneumatic retarders to control yard speed, electronic scales to weigh cars in motion, radar, television cameras and automatic car identification. It will be able to handle up to 3,000 cars per day, and will have space for 5,000 cars. Total trackage will include 50 miles of new track and 23 miles of existing track.

• CHESAPEAKE & OHIO/BALTIMORE & OHIO have in operation a radio station remote control system which employs only a single coded tone signal and is operable on open wire line, telephone cable or microwave and will function securely even when circuit noise is so great as to prevent useful voice communication. It can handle numerous remote control and answer-back functions too. The new system transmits a single serially-coded digital tone signal which is read by digital computer circuits. Safeguards are designed into the system to prevent false interpretation of commands.

Compact remote control consoles are located at the dispatcher's offices at Hinton and Huntington, W. Va. The dispatchers are able to select eleven base stations over 150 miles of main line railroad. The stations may be operated individually, or selected as a group. All of the base stations are tied to the dispatcher's office through an existing wire line which is also used for telephone and teletype carrier circuits.

Ordinarily, the dispatcher monitors all radio transmissions received by the base stations. However, he can mute any of the receivers by operating the selector keys on the remote control console whenever he wants to listen to radio transmissions received by only one of the base stations.

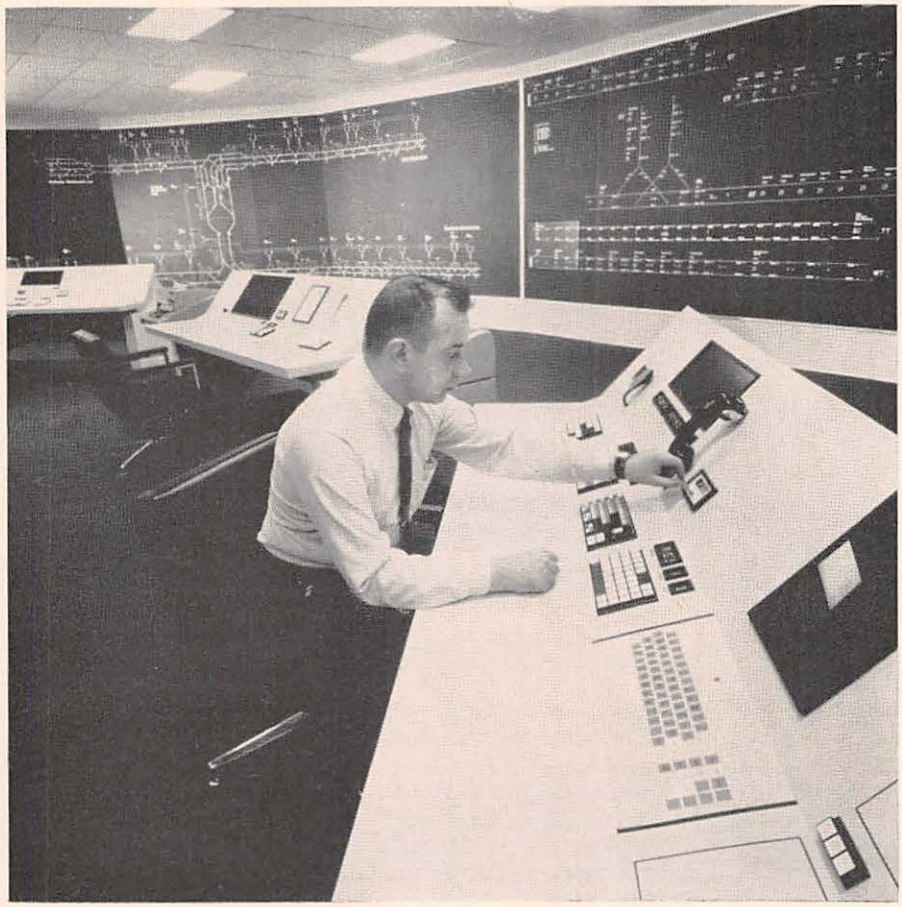
To transmit to a train or to other mobile radio units over any one of the base stations, the dispatcher momentarily presses an address key and selects the desired station alternately transmitting and receiving by pressing and releasing the PTT (press-to-talk) key.

When an address key is pressed, the selected station is locked on the telephone line and the dispatcher receives an indication that the station has been addressed. This also automatically mutes the receivers of base stations adjacent to the station selected to eliminate unnecessary noise on the dispatcher's line. When the selected station is released its adjacent stations are unmuted by momentarily pressing the "clear" key.

When the squelch of a base station receiver becomes unsquelched and creates a high level noise on the line, the dispatcher can quickly mute the offending receiver. To determine which receiver is at fault, the dispatcher operates the address and mute keys in sequence, thereby locating and disconnecting the defective receiver.

The codes are generated as parallel data and converted into serial

(Please turn to page 30)



A full-scale mock-up of the supervisory and control office for San Francisco's Bay Area Rapid Transit District has been constructed by Westinghouse Electric Corp. to check out the room's visual display characteristics, traffic flow and other engineering details. In this room, to be at BART's Oakland headquarters, are display panels 88 ft wide by 9 ft high. The panels will show graphically the condition of the system's electrification and support facilities and the location and movement of trains on the 75-mile rapid transit system, that is expected to be in service in 1970.

Cardion 960 MHz radio relay equipment for mobile radio: completely solid-state! FCC type-accepted!

Here, *NOW*, is the first completely solid-state 952-960 MHz radio relay equipment to be Type-Accepted by the FCC for Operational-Fixed service in the Public Safety, Aviation, Industrial, and Land Transportation radio services.

Not just a simple narrow-band remote control system, the Type 22B can control many mobile radio base and repeater stations when used with its companion solid-state Type 29A multiplex. Here is what you can get: ■ Up to 5 separate voice channels, each with its own press-to-talk control circuit up-link and carrier-operated relay circuit down-link. ■ Duplex operation over a single pair of radio frequencies with only one antenna and one transmission line. ■ A built-in service channel, independent from multiplex equipment. ■ AC line operation with battery standby, stock.

Why 960? With increasing legislation further restricting 450 (already limited to one voice channel), 960 is the logical place to go. Start now—expand later. You pay only for the channels you need.

So why not go Cardion 960? Get equipment which is "state-of-the-art"; a match *right now* for all *mobile systems.* Only Cardion has it.

Cardion COMMUNICATIONS

LONG ISLAND EXPRESSWAY, WOODBURY, NEW YORK 11797 ■ TWX 510-221-2179 ■ 516 WA 1-7300

(Continued from page 28)

data for transmission. A 15-bit code is used. The first seven bits comprise the message indicator and are used to alert all remote stations that a message is coming. This indication code, or recognition code, must be recognized at the remote locations before any subsequent commands will be considered. The next five bits form the address and the following three bits form the function command. The system can be expanded to handle combinations of up to 45 addresses and commands.

The station selection (address), PTT, channel change, mute, clear and other optional function codes are generated by pressing the applicable keys on the dispatcher's control console. Supervisory lamps are provided at each key which light up to indicate that the commands have been transmitted. A lamp over the address key has been provided to indicate that the station has actually been addressed. The control console also contains the receiving loudspeaker.

The parallel data are actually generated within the control transmitter where they are converted into serial data and then used to key a 2400-Hz crystal controlled tone generator whose on-off coded signal is fed into the line. Each bit is precisely timed to consist of 16 cycles of the 2400-Hz tone. Each 15-bit code requires 100 milliseconds for transmission and is repeated as long as a key is depressed. At each of the control receivers, the incoming tone signal is read. The bit length and recognition code must be error-free in order to be acceptable to the selected control receiver. The receiver has more than one chance to accept a code as long as a key is being pressed at the control transmitter, causing the code to be repeated over and over. The serial data are converted into parallel data and fed to logic circuitry which actuates SPDT output relays.

The system hardware was developed and is being manufactured by Electronic Modules Corp. of Timonium, Md. The equipment is comprised mainly of solid state computer modules manufactured by EMC. Overall system planning was engineered by Howard Alford, assistant communications engineer of the C&O/B&O under the direction of Paul A. Flanagan, superintendent of communications. Robert B. Barnhill, president of Barnhill & Associates, Inc. also participated in determining system requirements and in handling the engineering liaison between C&O/B&O and EMC.

• CHICAGO & NORTH WESTERN will soon be operating additional push-pull commuter trains made by Pullman-Standard Co. which has purchased four sets of train control equipment from General Railway Signal Co.

• CHICAGO & NORTH WESTERN which has been actively fighting the war on loss and damage, has come up with a hotbox simulator in which it hopes to be able to study and improve human efforts in the hotbox detection area, particularly the work of train crews and dispatchers as regards their actions following detections spotted by these detectors. The following is from a March 25, 1968, *Railway Age* article on C&NW's accident and loss prevention activities:

Meanwhile, the search continues for new approaches to the problem of getting men and machines to work more safely together. One example: Man/-machine audits. The hotbox detector is a marvelous device—but there's still a human link needed between detection and action, to prevent a derailment. So, as a means of checking both on the detectors and on the employees responsible for acting on detector indications, C&NW developed a hotbox simulator—a simple device attached by magnets to the journal box. The simulator trips the scanner as the car passes it, the indication goes onto the detector readout sheet. And the railroad has an audit on the machine and man—whether the machine functioned properly, whether the man acted according to instructions. Is the effort worthwhile? The record says it is. From the recent past, A&LP people can cite historical instances where derailments resulted from the kind of human error the hotbox simulator is designed to detect. In three cases, the hotbox detector indicated the presence of an overheated journal but the individual reading the tape took no action; in a fourth case, a dispatcher stopped the train but the crew couldn't find the hot journal.

North Western isn't running a "big brother's watching" type of operation. What it is running is a program dedicated to safety improvement and improved control of casualty losses. A&LP works as a kind of loss-reduction profit center. If recorders or simulators or radar or other types of performance-measuring instruments will help, they'll be used. Right now, in fact, North Western is even making use of portable video cameras and recorders in the field.

• CHICAGO TRANSIT AUTHORITY'S BOARD approved an application to the US Department of Housing and Urban Development for a demonstration grant for an automatic bus monitoring system which applies computer technology and advanced radio communications techniques to provide centralized information and control.

With the proposed system, basic information of identification, location and alarm status of each bus is automatically provided on a continuous basis at a centralized control point. This information will be used to provide schedule adherence data, operational status, and alarm conditions. The system also will provide direct two-way voice communications with any bus on an individual basis.

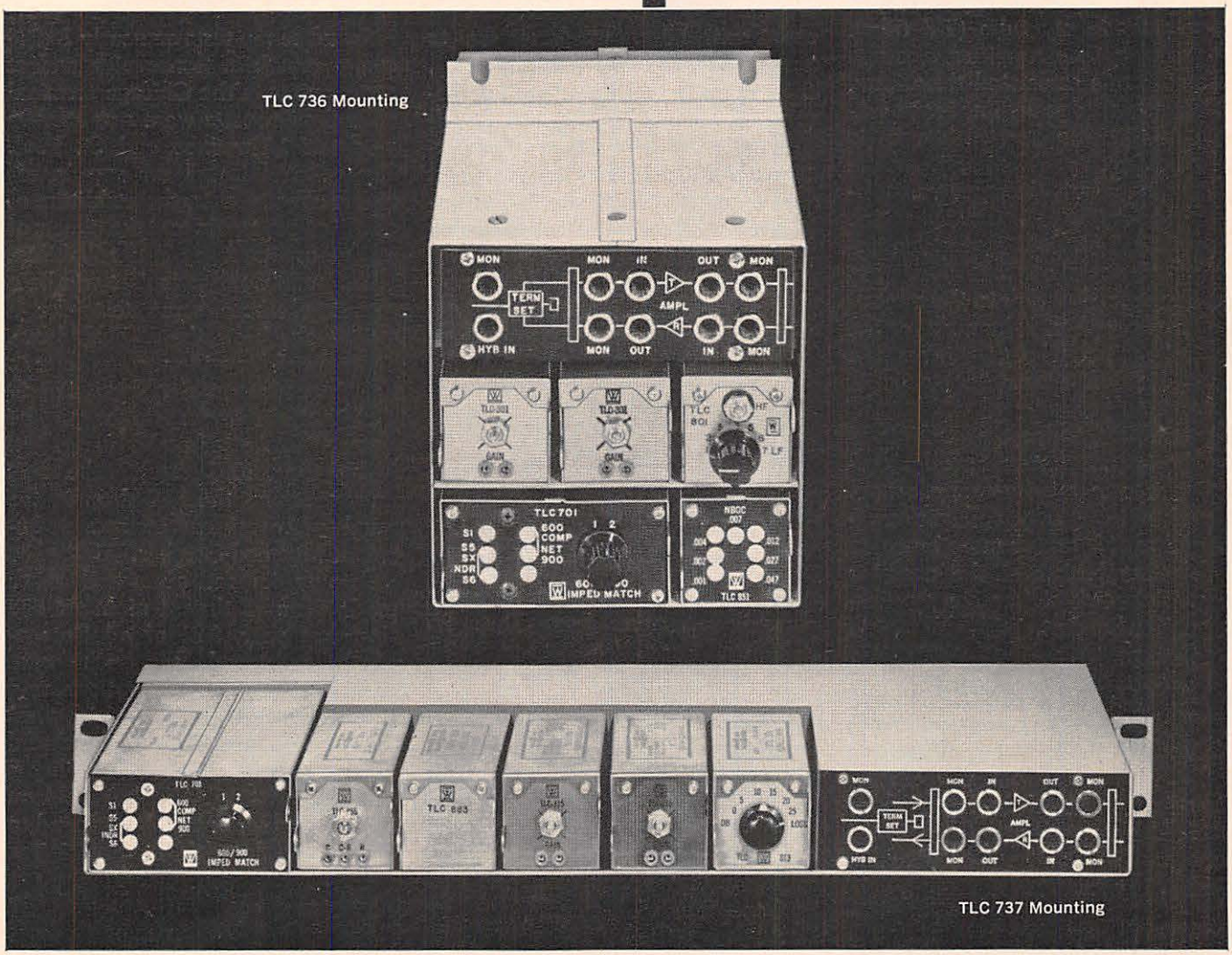
The demonstration project proposes to provide the monitoring system for 500 buses. This will permit almost all buses on the early morning or "owl" shift to be fully equipped. $1,549,000 will be provided by HUD and $451,000 by CTA. A four-year time period has been set up for the project. Two years for manufacture and installation of equipment, and two years for testing.

The essential elements of the bus monitoring system are: A control center, including the use of a computer and its peripheral equipment; electronic wayside equipment located throughout the city; and two-way radio and electronic data equipment aboard buses.

Basically, the operation of the system is that through the use of electronics, the bus and route numbers, and location will be transmitted to

(Please turn to page 32)

Having voice frequency transmission problems...



...with Carrier derived V.F. extensions? Mobile radio voice circuits? PBX extensions? Tie lines? Conference bridges?

Webster Electric's TLC line can solve these and many similar problems easily and economically. For example: Webster's TLC Voice Frequency line includes a variety of equipment mountings for either central office installation or out-of-the-way locations. A wide selection of modular plug-in apparatus is available including repeater amplifiers, line level control, bridging and monitoring amplifiers—terminating sets, equalizers, networks and power supplies. Further, the TLC line can be arranged in a variety of circuit configurations whether 4 wire-4 wire, 2 wire-4 wire or 2 wire-2 wire.

Your Graybar representative will be glad to furnish you further information upon request.

GraybaR

local service to industry—nationwide

Circle 8 on reader service card on page 38

(Continued from page 30)

a computer. The information will be stored there until requested from the control center. At the control center the information is visually displayed on a cathode ray tube (TV tube). At the same time, a written record is printed on an associated teleprinter.

The second equally important feature of the proposed system is its alarm capability. When assistance is needed on a bus, the operator unobtrusively activates a switch which automatically transmits an alarm signal which includes the bus and run numbers and location to the control center. This is visually seen at the control center. The dispatcher can then send whatever assistance is needed.

In addition to location and alarm capability, the system includes normal two-way voice communication. The dispatcher may call and communicate with one or more buses on a selective basis and the operator may originate a call by simply picking up the handset.

• DETROIT & TOLEDO SHORE LINE has received approval from the Federal Railroad Administration of DOT to install a traffic control system on one track replacing automatic block signaling on two tracks between Ecorse and Gilbralter, Mich., 11 miles.

• ELECTRONIC INDUSTRIES ASSOCIATION has stated that the needs of land mobile radio users can be met only by allocation of spectrum space below 600 mHz. EIA's Land Mobile Communications Section said that the potential usefulness of bands above 600 mHz "is limited by the technical factors affecting system and equipment design and performance at these frequencies. The effect of these technical factors now, and in the forseeable future, is to make impractical the use of these frequencies for land mobile radio for all but very restricted and special applications," reported *Telecommunications Reports.*

Further, the EIA Section said "most current work at these higher frequencies is of a fixed point-to-point nature, such as found in broadcast TV and microwave systems. In both systems, the radio paths are between stationary locations, and are designed for line-of-sight clearances using high gain antennas . . . Base mobile radio systems, in contrast, require omni-directional coverage to mobiles moving in obstacle environments with radio path losses due to terrain, foliage, and buildings . . . After more than a decade of component, equipment, and system development, satisfactory system performance at 450 mHz has been attained only in areas offering suitable antenna sites . . . Hence, it is unreasonable to expect that system performance at 900 and 2100 mHz would be usable for land mobile systems without sharply reduced communications coverage, range, and performance."

• FEDERAL COMMUNICATIONS COMMISSION has split the 450-470 mHz band providing for 165 new channels to the public safety, industrial, and land transportation radio services. The additional assignments were developed by reducing channel separation from 50 to 25 kHz.

• GREAT NORTHERN has ordered type D1 CTC equipment from General Railway Signal Co. for control of 15 mainline locations between Sandpoint, Ida. and Troy, Mont., 65 miles. A Traffic Master pushbutton control machine will be located at Spokane, Wash.

• LOUISVILLE & NASHVILLE has ordered 131 portable radios from the Signal & Communications Division of WABCO.

• MILWAUKEE ROAD, in its efforts to reduce loss and damage and also reduce impacts in its classification yards, has been making use of a portable radar meter. According to the March 25, 1968 *Railway Age*: Milwaukee Road is getting ready to repeat tests using a radar technique that helped yard operators cut the number of overspeed impacts by almost 51% last year at Bensenville yard, near Chicago. Borrowed from the highway patrol, the technique involves the use of a $1,200, two-suitcase-sized electronic watcher and timer to clock car speeds between points in the humping and other yard operations.

As soon as the weather's warm enough to allow yard personnel to stay outside for long periods of time, the radar device and others like it will return to work at the Bensenville hump yard and at other points. Over a six-month period in 1967, Milwaukee ran tests on nearly 15,000 cars a month at Bensenville and at other points in the Chicago terminal area. Similar tests were run at class yards at Milwaukee and St. Paul. The railroad tested car speeds, retarder effectiveness, the condition of classification tracks and the effects of track conditions on car rollability. The first 1968 radar project will be a repeat of those same tests—for a double-check on the 1967 findings. Then the radar will move on to tests aimed at determining how certain classification tracks ought to be changed for better car handling.

And those 1967 results? The most important was the 51% drop in the number of overspeed car impacts between June and October. Milwaukee calls any impact overspeed that's made at more than 4 mph. At one time last year, 95% of all Bensenville's overspeed couplings were chargeable to hump operations, says R. J. Kemp, assistant to the vice president-operations. This was reduced to 22%. Kemp's chief responsibility is claim prevention. And he's sold on the radar idea: "Radar has proved to be a versatile tool for pinpointing the causes of damage in all aspects of car-handling."

Main goal of the testing, then, was to determine first the extent of overspeed impacting on cars handled over the hump, and subsequently to get cars moving down the hump into group tracks at 5 mph—for the desired 3-4 mph coupling speed. Before radar testing was started, a number of couplings were made at speeds in excess of 4 mph.

In addition to the reduction in the number of overspeed impacts, there were these other important results:

- The number of cars that stalled before coupling was reduced by 69% during the study period. This is significant because "stalling and impacts follow a close line." Kemp says.
- The number of cars entering class tracks faster than the desired 5 mph was reduced by 92.5% between June and October, without a slowdown in the operation.
- On some yard track curves, car

(Please turn to page 34)

Does External Interference plague your line overlay?

Put a Harmon Model "1210"
FM tone Modulated Line Overlay
in service *on a no-cost, no obligation basis!*

70 channels from 452 Hz to 350 KHz with 6 subtones available.

It's another "first" from HARMON: A single, inexpensive on-off FM tone modulated tone channel for the performance of a remote function, or to relay a remote indication. And it's FM—virtually free from the interference that plagues old-style AM tone modulators!

Check these key features of the Harmon 1210: Built-in surge protection. Fail-safe internal circuitry, with relay normally energized. 10 to 14 VDC input voltage; adjustable output power to +15 db (600 ohms). Drives any relay up to 1000 ohms (or specify single set of form C relay contacts.) Environmentally stable under extreme temperature range. Compact, just 8½" high including terminals. Optional packaging available to provide up to 4 transmitter or 3 receiver channels in a 19" cabinet, 4¼" high.

Write, wire or phone for complete specifications... and put the Harmon 1210 to the test at no cost, no obligation to you.

ELECTRONICS HARMON

HARMON
ELECTRONICS, INC.
Grain Valley, Mo. • Telephone: (A.C. 816) 249-3338
20 Years of Service to Railroading.

Circle 17 on reader service card on page 38

(Continued from page 32)

rollability was improved by application of graphite to the rails.

• The curvature alignment and grading of some yard trackage was improved.

Again it was a matter of education. Kemp says that yard operators had little trouble realizing that changes in control were needed, once they saw the evidence supplied by the radar.

• NORTHERN PACIFIC has installed a central microwave check-panel in the St. Paul office of D. C. Hill, superintendent of communications.

The panel provides a constant and instantaneous visual status report on the microwave network from the Twin Cities to Seattle.

The panel is 10.5 ft long and 4 ft high and is mounted on a large cabinet which houses terminal boxes that connect the panel with the microwave network. Painted on the surface of the panel is a large map of the railway system and the location of each of the 86 microwave stations.

The microwave stations are identified on the map by 86 pairs of lights, one green and one red for each station. Under normal conditions, all of the green lights glow, indicating proper functioning of the system.

A malfunction of equipment, or any change from normal operation of any particular station, causes the green light representing that station to go out and switches on the red light to pinpoint the system location of the malfunction.

Time zones are marked on the map and clocks built into the panel show the time in each zone.

The check-panel installation was designed by the Collins Radio Co., which has been the prime contractor for most of NP's existing microwave facilities.

The panel, with its direct link to the microwave system, will indicate such abnormal conditions as failure of tower lights, interruption of the AC current in station circuits, failure of a transmitter, receiver, battery charger or generator, heating system failures, and even illegal entry.

Each station has stand-by equipment which automatically starts functioning if its counterpart fails. If, for example, commercial electrical power is interrupted, a bank of batteries takes over. If the interruption lasts more than 10 to 12 minutes, an AC generator starts automatically to relieve the batteries of the load and supply the necessary power until commercial power is restored.

Stand-by equipment also takes over automatically in the event that transmitters, receivers or battery chargers fail.

When the malfunction is corrected, either automatically at the station itself, or by a service crew, the red light on the central panel goes out and the green light goes back on.

The information which is required for the operation of the display map in St. Paul is acquired from the basic FA-102 (tone on) fault alarm system. The basic FA-102 system is used to activate a secondary FA-102 fault alarm and voice channel system which transmits the station alarms to St. Paul.

• PENN CENTRAL has installed a

Explore the New World of Transportation

for Real Career Growth Opportunities

Westinghouse Electric Corporation, Transportation Center, is a newly formed activity organized solely to help develop revolutionary new mass-transit systems. The transportation future of the world's largest cities lies with Mass Transit. Get in on the ground floor with Westinghouse!

Immediate career opportunities exist for engineers with the following qualifications:

CIRCUIT DESIGN ENGINEERS

To be responsible for design and development of electronic units required for communications to and control of moving trains. Also responsible for field measurements and results analysis and coordination with drafting and manufacturing departments. B.S.E.E. or Electronics Degree required with minimum 2 years' experience in related field.

SYSTEMS ENGINEER

Background in packaging of solid state and relay logic hardware to package rapid transit system control hardware, involving a combination of solid state and relay logic. Will also develop wiring diagram systems. E. E. Degree required.

SALES ENGINEER

To cover all concepts of automatic train control systems, communications systems, system engineering studies and hardware components as well as control and supervisory computer systems. E. E. Degree required or electronics and experience in railway signaling and/or communications or computer applications in research engineering or sales.

COMMUNICATIONS ENGINEER

Experience in office wiring equipment layout as done with a railroad doing layout of dispatchers' and wire chiefs' offices. Work involves assigning cable conductors, terminals, sizing cables and duct lines. B.S.E.E. Degree required.

Don't miss this chance to get in on the ground floor of an exciting new field where growth is the promise of the future! Enjoy the assurance of rewarding financial and promotional recognition for your efforts and abilities.

To arrange a personal interview, send your resume in complete confidence today to:

Mr. E. H. Ruehl

Westinghouse

ELECTRIC CORPORATION

Transportation Center

Avenue A & West Street East Pittsburgh, Pa. 15112

An Equal Opportunity Employer

Circle 22 on reader service card on page 38

new pulse modulated track circuit on the Zoo Secondary Track for control of automatic block signals in electrified territory between Zoo Interlocking and North Philadelphia.

The new track circuit equipment eliminates the requirements for signal control wires as well as the need for insulated joints and impedance bonds at intermediate signals. The equipment was manufactured by Marquardt Industrial Products Co.

• PITTSBURGH & LAKE ERIE has received approval from the Federal Railroad Administration of DOT to install a traffic control system replacing existing manual block on single track between Port Vue (MB) and West End of West Newton, Pa., and between east of West Newton and Dickerson Run, Pa., 33 miles.

• SANTA FE PIPELINE CO. has ordered a control system from the Signal & Communications Division of WABCO to be installed on its pipeline between Amarillo, Texas and Clovis, N.M. The new line will be used as a common carrier to transport diesel fuel for the Santa Fe and jet fuel to Cannon Air Force Base near Clovis.

• SEABOARD COAST LINE has ordered 60 model 2R radios and 20 portable Carryphone radios from the Signal & Communications division of WABCO.

• TELPAK users may have several months to restructure their communications networks because the FCC has granted permission to AT&T to cancel filed tariff revisions. Thus, the further revised Telpak tariff could be filed effective June 1, and providing the 90-day statutory maximum suspension, it would probably not be actually effective until Sept. 1, 1968. AT&T has stated that the revised rates are substantially lower than those filed on Feb. 1. The new Telpak tariff, which was filed March 25, to be effective June 1, provides for increases in the per mile monthly charges for telpak C to $28 and for telpak D to $60. Service terminals for use as channels of a lesser capacity (than the full bandwidth) would be $25 a month for voice, teletypewriter and narrow band data for the first installation in an exchange and $10 for each additional terminal at the same location. Also, included in the tariff revisions was a refiled regulation permitting a customer to order additions to Telpak base capacity from either the telephone companies or the Western Union Telegraph Co. without regard to which carrier originally furnished such base capacity.

Railroad Personnel

• CHESAPEAKE & OHIO/BALTIMORE & OHIO: **H. N. Laden,** director of research services, has been appointed assistant vice-president, research. **Joseph J. Schmidt,** assistant director of research, succeeds Dr. Laden.

• ELGIN, JOLIET & EASTERN: **Floyd M. Harris,** T&T foreman, appointed chief lineman system, succeeding **William E. Storey,** who has retired.

• SOUTHERN: **Virgil L. Cosey,** signal superintendent, Central of Georgia, has been appointed district signal and electrical engineer at Macon, Ga. **Forrest H. McIntyre,** S&E supervisor at Danville, Ky., has been appointed district S&E engineer at Knoxville, Tenn. **Marion A. Otterbourg, Jr.,** S&E supervisor at Louisville, Ky., has been appointed district S&E engineer at Greenville, S.C. **Rayford C. Pace,** assistant engineer S&E at Atlanta, has been appointed district S&E engineer at Birmingham, Ala. **Robert M. Soule, Jr.,** assistant S&E supervisor at DeButts yard, Chattanooga, Tenn., has been appointed process engineer-yards, Chattanooga. **Robert Harp, Jr.,** S&E supervisor at Lexington, Ky., has been appointed electrical engineer at Atlanta, Ga. **Thomas L. Worthington,** supervisor of computer operations, Atlanta, appointed cost accountant, S&E office, Atlanta. **Lloyd A. Forlaw,** general S&E supervisor, Charlotte, N.C., appointed assistant district S&E engineer, Greensboro, N.C. **Bernard G. Webb,** general S&E supervisor at Chattanooga, appointed assistant district S&E engineer, with the same headquarters. **Ralph E. Davis,** assistant S&E supervisor, Greensboro, N.C., appointed S&E supervisor at Lex-

(Please turn to page 36)

Microwave Users . . .

PORTABLE FREQUENCY METERS

to tune microwave transmitters to ±0.01% frequency accuracy

- frequency ranges from 500MHz to 18000MHz
- fully self-contained and easy to use
- ±0.01% accuracy: 0°C to 50°C
- passive operation
- FCC Type accepted

The WCF Series Portable Frequency Meters are precision instruments for field or laboratory measurement of microwave frequencies in the range of 500MHz to 18,000MHz.

Extremely easy to operate and fully reliable under all conditions, these resonant cavity meters require no external power aside from the RF source being measured. Each is complete with rugged carrying case, inside-the-cover calibration chart and compartment for accessory cables and adapters.

Send for complete specifications.

E-5

FREQUENCY ENGINEERING LABORATORIES
a division of Harvard Industries, Inc
Farmingdale, New Jersey 07727
(201) 938-9221 / TWX (201) 938-2456

Gentlemen:

☐ Please send additional information on your WCF Series Portable Frequency Meters.

Name _____

Title _____

Company _____

Address _____

City _____ State _____ Zip ___

Circle 18 on reader service card on page 38

(Continued from page 35)

ington, Ky. **Richard W. Linn,** assistant S&E supervisor, Birmingham, appointed S&E supervisor, Norris yard, Birmingham. **John E. Peeler,** assistant S&E supervisor, Inman yard, Atlanta, appointed S&E supervisor, there. **Robert F. Thompson,** draftsman in the S&E office Atlanta, appointed S&E supervisor DeButts yard, Chattanooga. **Howard K. Thornburg,** assistant S&E supervisor, Knoxville, appointed S&E supervisor at Sevier yard, Knoxville. **Carey H. Waller,** assistant S&E supervisor, Macon, Ga., appointed S&E supervisor Brosnan yard at Macon. **E. Lee Crowe,** assistant S&E supervisor Morristown, Tenn. appointed assistant S&E supervisor, Danville, Ky. **William E. Waters, Jr.,** construction supervisor S&E at Chattanooga, appointed assistant S&E supervisor, Louisville, Ky.

Supply Trade News

• ANACONDA WIRE & CABLE CO.: **Andrew C. Verock** has been appointed chief engineer, overhead products. A graduate of Tri-State College in Angola, Ind., with a BS degree in electrical engineering, Mr. Verock had been associated with Hubbard & Co., as chief engineer of their pole line hardware department.

• ANDREW CORP. has recently opened a district office at 11520 Lake City Way, N.E., Seattle, Wash. 98125. **John Van** has been appointed district manager and will serve customers in Washington, Oregon and Alaska.

• CABLE COMMUNICATION SYSTEMS, INC.: **Kenneth P. Roberts,** manager of programs for advanced project division, Simplex Wire & Cable Co., has been appointed general manager and director of marketing. **G. William Carter III,** manager of communications systems engineering for Simplex, has been appointed manager, application engineering. **Serge Elian,** area sales manager, export division of Compagnie Industrielle des Telecommunications, has been appointed director of engineering. **John A. Lawlor,** senior applications engineer at Simplex, has been appointed manager of operations and administration. **Christian Ducret,** an engineer for CIT, has been appointed systems engineer. **Robert Kelley,** senior communications engineer at Simplex, has been appointed senior communications engineer.

G. R. Petersen
General Electric

L. Keith Elrod
General Electric

R. L. Casselberry
General Electric

Sherman B. Weiner
Stromberg-Carlson

• GENERAL ELECTRIC CO.: **Glenn R. Petersen** has been appointed manager of the communications products department, mobile radio business section. A native of Milwaukee, Mr. Petersen received an electrical engineering degree from the University of Wisconsin. He joined G.E.'s engineering test program in 1950 and has advanced through various positions in sales, product planning and marketing.

L. Keith Elrod has been appointed manager—marketing for G.E.'s mobile radio business. A native of Dahlonega, Ga., Mr. Elrod received a bachelor of science degree in physics from North Georgia College in 1949. He joined G.E. as a communications engineer in 1954 and later served in various sales and engineering capacities prior to his recent appointment.

Robert L. Casselberry has been appointed manager of marketing for the communication products department. He has previously served in marketing and product management positions for GE. He is a native of Pittsburgh, Pa. and graduated from Pennsylvania State College in 1940 with an electro-chemical engineering degree.

Assistant Communications Engineer

Applicant must have a thorough knowledge of railroad communications. Headquarters at Minneapolis, Minn. Salary commensurable with experience and education. Address replies to Asst. Chief Engineer, S&C, Soo Line Railroad Co., Box 530, Minneapolis, Minn. 55440.

An equal opportunity employer.

• MID-CONTROL CO.: **Robert W. Buchanan** has been named sales manager with headquarters in Des Plaines, Ill. He previously had been associated with Railroad Repair & Supply Co. and with the Milwaukee Road purchasing department.

• MOORE ASSOCIATES: **Cecil A. Moore** has been appointed systems sales engineer at a newly established southwest regional office in Houston, Tex., in the San Jacinto Building. A graduate of Texas A&M University in 1959 with a degree in electrical engineering, Mr. Moore had been previously associated with Dresser Controls and Honeywell, Inc.

• STROMBERG-CARLSON: **Sherman B. Weiner** has been appointed vice-president, research and engineering. Mr. Weiner is a graduate of the University of Michigan with a B.S. degree in electrical engineering. He joined S-C in 1947 as an engineer in the telephone test laboratory. Later he was associated with U.S. Instrument Corp., which merged with S-C in 1956. Since 1956, he has been director of research and engineering.

• UNION CARBIDE CORP.: **F. Bruce Vernon** has been appointed executive vice-president of the Carbon Products Division. A graduate of Lafayette College with a degree of B.A. in 1938, Mr. Vernon has been in various management and supervisory positions for Union Carbide. In 1965 he was appointed vice president of production for the Carbon Products division.

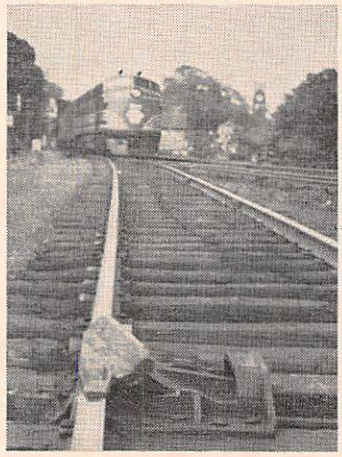
SECURITY DEMANDS A Hayes ALL-STEEL DERAIL

at every main-track turnout

The main track needs positive protection. No available means of guaranteeing its security should be omitted.

Signals and track circuits have their field, but neither provides the physical protection afforded by a Hayes Derail.

Hayes Derail—the most universally used track device. Designed and built by men whose only business is railroads.



Free leatherette ring-binder catalog of world's most-specified derails, bumping posts and wheel stops (including periodic supplement sheets). Write on letterhead.

Specialists since 1903 in side track security

Hayes Track Appliance Co.

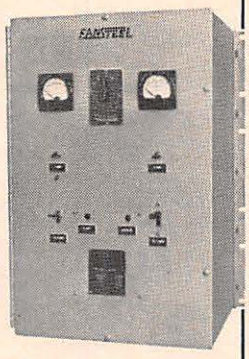
RICHMOND, INDIANA 47374

Circle 20 on reader service card on page 38

Charge!

Fansteel Constant Potential Ⓟ Battery Chargers assure reliable recharge for lead-acid and nickel-cadmium batteries. Automatic, maintenance-free units are designed for unattended long-life operation . . . complete battery protection against overcharging, overheating or gassing. Output voltage regulation within ±1%.

Ruggedly constructed units ideal for utility, industrial and microwave installations where dependable power source is essential.



For complete data . . . ask for Bulletin 6.511-3! Call, circle reader service number, or write.

FANSTEEL
Rectifier Products

FANSTEEL METALLURGICAL CORPORATION
NUMBER ONE TANTALUM PLACE
NORTH CHICAGO, ILLINOIS 60064

Circle 19 on reader service card on page 38

Advertisers' Directory

C & D Battery Division of Eltra Corporation 11
Cardion Communications 29
Collins Radio Company .....IBC
Copperweld Steel Company 4

DuMont Mobile Communications Division 20

Edison Industries, Thomas A., Primary Battery Division 7
ESB, Inc., (Exide Industrial Division) 3

Fansteel Metallurgical Corp. 37
Frequency Engineering Laboratories 35

General Railway Signal Company 10
Graybar Electric Company 31

Harmon Electronics, Inc. 33
Hayes Track Appliance Co. 37

Joslyn Electronic Systems, Division of Joslyn Mfg. & Supply Co. 8

Kerite Company, The ..... FC

Lenkurt Electric Company 9

Marquardt Industrial Products 22

Raco (Railroad Accessories Corp.) .....IFC

SCM Corporation, Kleinschmidt Division 6
Servo Corporation of America 27
Stromberg-Carlson 12

Western Railroad Supply Company .....BC
Westinghouse Electric Corp. 34

RY SIGNALING & COMMUNICATIONS
SUBSCRIBER SERVICE

Please include address label when writing about your subscription to help us serve you promptly.

Write to: P.O. Box 961, Bristol, Conn. 06010

CHANGE OF ADDRESS: Notify us five weeks before your intended move in order not to miss any issues. The Post Office forwards magazines only at the subscriber's instructions and expense.

TO SUBSCRIBE: Check proper squares below and give business or job data.

☐ New ☐ Renewal
☐ 1 yr $3 ☐ 2 yrs $5
☐ Remittance enclosed ☐ Bill me later

Name of Railroad

Title or position

NEW ADDRESS

name please print

address

city

state zip-code

AFFIX LABEL

If you have no label handy, print OLD address here.

name
address
city
state
zip-code
please print

PRODUCT NEWS

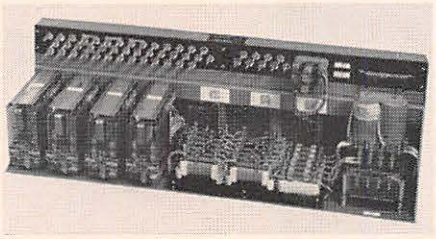
Retarder

New type E 160 electric retarder controls cars of 160 tons with high precision, and without increased retarder length, yet does not "squeeze out" lightweight cars. The retarder fits compactly into available space. Efficiency is increased by use of longer levers, and by modification of controller cams. *General Railway Signal Co. Circle 101 on Reader Service Coupon.*

Portable Radio

The new Carryphone III portable radio weighs only 28 oz. It has built in shock protection plus a rugged die-cast exterior to withstand the bruising impact of day to day operations.

There are exclusive transmitter audio compression circuits plus an extra sensitive receiver with full-range sound quality. Carryphone III will operate on mercury or rechargeable nickel-cadmium batteries. *Signal & Communications Division, WABCO. Circle 102 on Reader Service Coupon.*



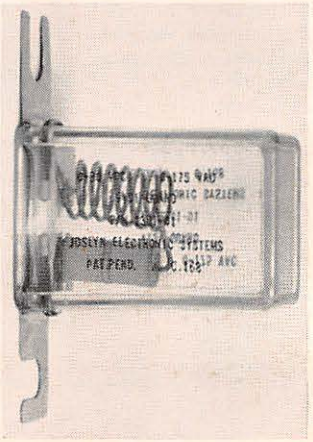
Crossing Control

The HX-3GAL highway crossing code control unit consists of the necessary relays including the flasher and a 3-sec slow release relay for controlling a gate. It can be used with predictor units, other standard Transco highway crossing control packages, or with standard wiring. *Transcontrol Corp. Circle 103 on Reader Service Coupon.*

Insulating Material

Steel-reinforced urethane rubber insulating pieces are now available for insulated joint usage. These Neothane synthetic rubber clad bushings and end posts were laboratory and field tested, with no failures under tension loads of 120 tons and compression loads of more than 60 tons.

Bushings range in size from inside diameter of 29/32" to 1 3/16"; outside diameter of 1 9/32" to 1 5/8" and lengths of 1 1/8" to 1 1/2". End posts are available for rail from 100 lb to 140 lb in various standard makes. *Goodyear Tire & Rubber Co. Circle 104 on Reader Service Coupon.*



Signal Protector

A new signal protector features response time as fast as 0.15 microseconds at 10 kv per microsecond rate-of-rise with transient clipping starting as low as a 500 volt peak. The device, designated the Visi-Guard 2300, is designed for application on 0-30 volt DC, 0-175 volt AC rms and 0-260 volt DC (where available current is less than 4 amp) signaling and communications systems. The device protects the equipment against transients from sources such as lightning, induction, static, and switching surges. The protector automatically extinguishes and is self-restoring.

Hermetic sealing eliminates moisture, humidity, dust and temperature problems, and prohibits emission of gases, burning and exposed arcing or sparking. Components are completely encapsulated in clear transparent silicone and a permanent clear plastic cover permits easy inspection of the unit. Flexible mounting legs also serve as the terminals. Visi-Guard is designed to directly replace arresters using the molded plastic base, the AAR porcelain base or the three-post porcelain base. *Joslyn Electronic Systems. Circle 105 on Reader Service Coupon.*

Railway Signaling & Communications

14 E. Jackson Blvd., Chicago, Ill. 60604
Attn: R. W. McKnight

Reader Service Card 5/68

Circle numbers for more information about products and services. **1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51**

101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130

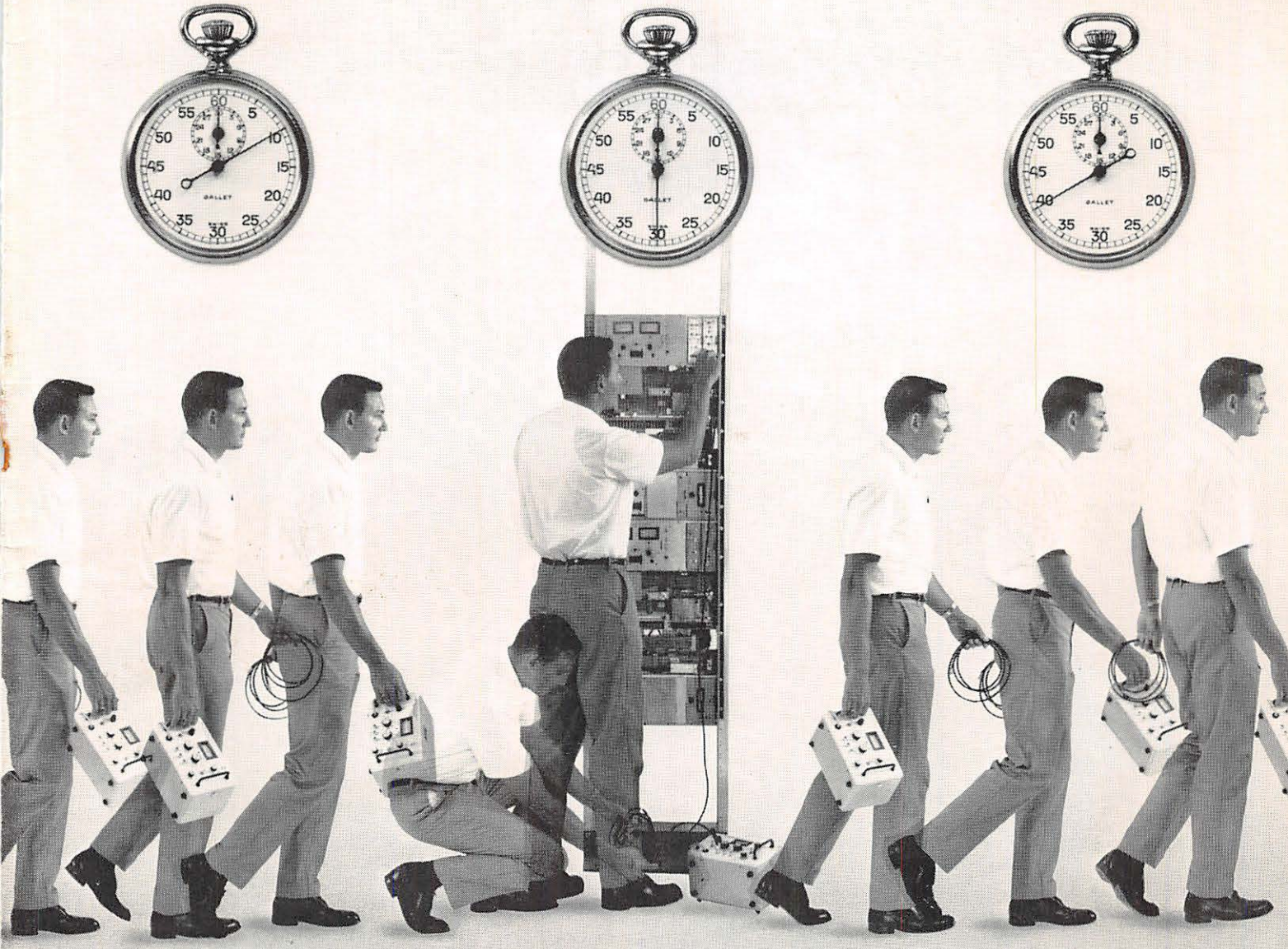
NAME .....

TITLE ..... RAILROAD .....

ADDRESS .....

CITY ..... STATE ..... ZIP # .....

THIS COUPON MUST BE USED ON OR BEFORE JULY 31, 1968



Deviation and Level Adjustments in Seconds

That's how long it takes one man to make these adjustments on Collins new "D" series of remodulating microwave systems. These adjustments — the two most important of the maintenance procedures — can be made while the system's in service.

With new transmitter afc circuitry (a built-in receiver), rf deviation can be checked and adjusted with only one piece of equipment — Collins' new inexpensive pilot selective voltmeter. Level adjustments can be made easily and accurately at all baseband points with a Collins 70D1-2MW Deviation Calibrator and an ac voltmeter.

That's all the test equipment needed for minor maintenance. It's lightweight, inexpensive, and specially designed for field operations. All other test equipment — including metering equipment, jackfields, isolated coaxial test jacks, test points, and waveguides — is built in. All with front access.

For additional information on the most easily maintained remodulating microwave system in the industry, contact Collins Radio Company, Microwave Marketing Department, Dallas, Texas. Phone: (214) AD 5-9511.

COMMUNICATION / COMPUTATION / CONTROL

COLLINS

COLLINS RADIO COMPANY / DALLAS, TEXAS • CEDAR RAPIDS, IOWA • NEWPORT BEACH, CALIFORNIA • TORONTO, ONTARIO

Bangkok • Beirut • Frankfurt • Hong Kong • Kuala Lumpur • Los Angeles • London • Melbourne • Mexico City • New York • Paris • Rome • Washington • Wellington

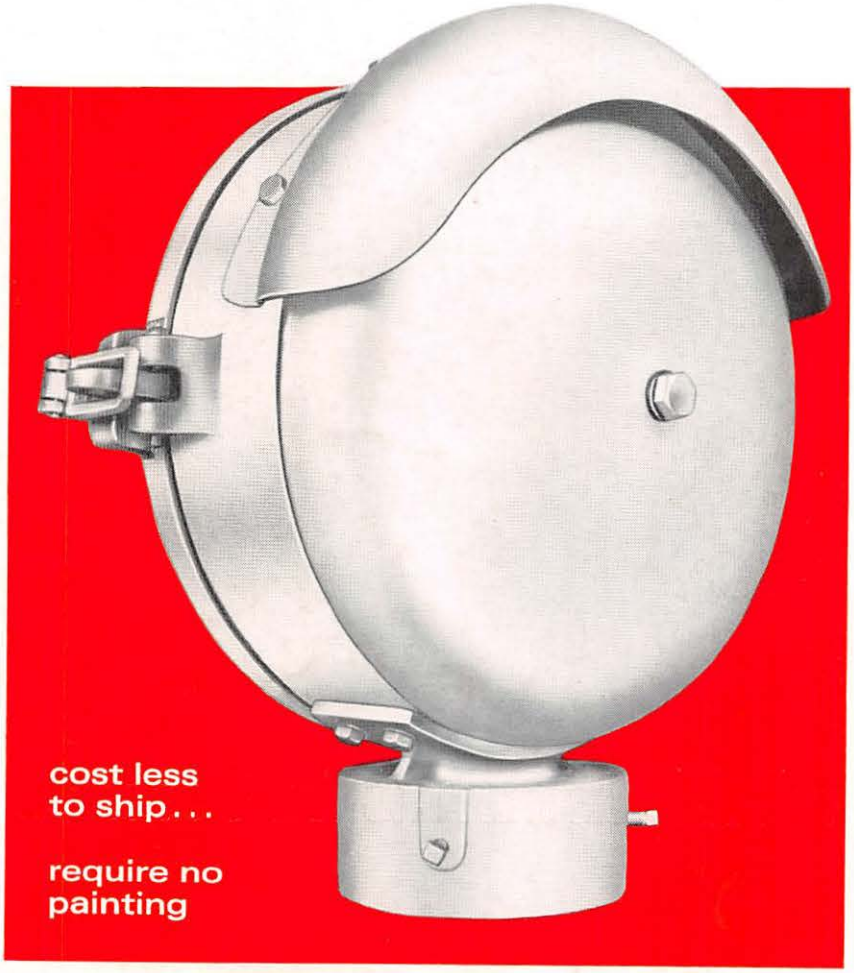
Circle 21 on reader service card on page 38

NOW: LESS WEIGHT, LESS MAINTENANCE with . . .

WESTERN

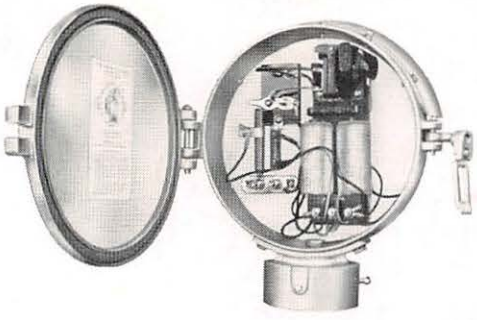
ALUMINUM HIGHWAY CROSSING BELLS

with BELL STEEL GONGS TYPES 222 AND 1275



WEIGH 40% LESS THAN CAST-IRON BELLS

These new Western Aluminum Highway Crossing Bells, Types 222 and 1275, are lighter in weight and as reliable as ever. Specifically: the Type 222 Aluminum Bell weighs only 29 lbs., as against 48 lbs. for that of cast iron, and the Type 1275 in Aluminum weighs only 20 lbs. against 32 lbs. for the cast iron. Aluminum parts include: housing, cover, rainshield, and mounting socket. These changes make quite a difference in weight. But there's no difference in quality and tone: for they have the same dependable mechanism as before; as always, parts are fitted snugly to assure bug-, dust- and weather-proofing, and *the gong is still made of bell steel.*



TYPE 222: Twelve-inch bell steel gong; 200 strokes per minute; 6 to 600 volts D.C., as specified.

TYPE 1275 (not shown): Same as Type 222, except with eight-inch bell steel gong (softer tone); 225 strokes per minute; 6 to 16 volts D.C.

Making greater use of aluminum throughout, these Bells are complementary for use on Western's Aluminum Highway Crossing Signal, TYPE A-479-A, with Flashing Light, TYPE 970-201, on the Aluminum Cantilever Assembly, TYPE A-740, also on Model 10 Gates.

Over 100,000 Western Bells in use.

For additional information on bells and bell mechanisms, see your WRRS Catalog, Section B, or write to us:

WESTERN RAILROAD SUPPLY COMPANY

Division of WESTERN INDUSTRIES, INC.
2742 West 36th Place, Chicago, Illinois 60632
CANADA: Lyman Tube & Supply Co., Ltd., 5420 Pare Street, Montreal 9, Quebec

7908

Circle 3 on reader service card on page 38